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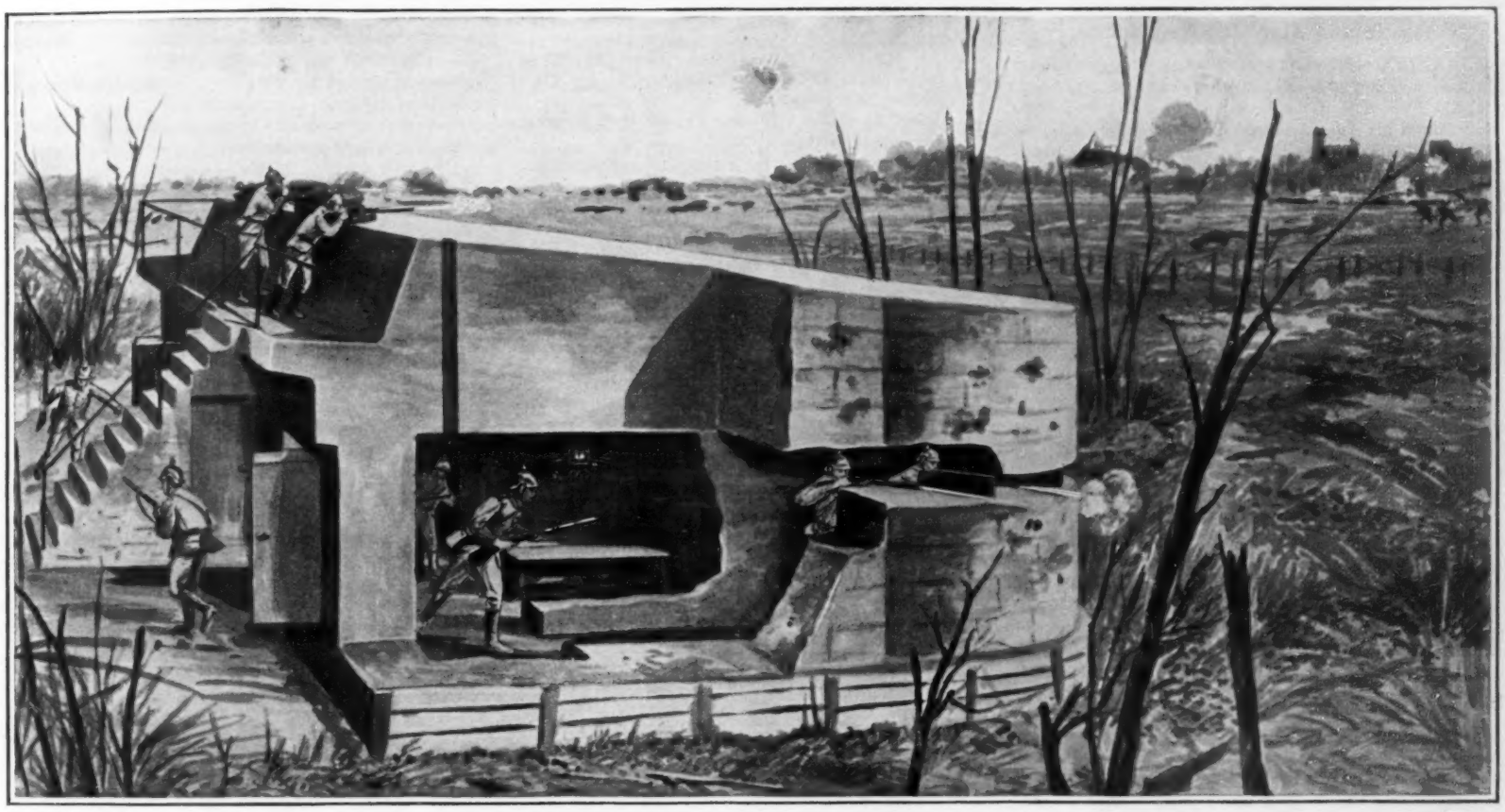

A concrete blockhouse or large pill-box typical of the many used by the Germans in their 1917 system of flexible defense on the Western front

The Trench System of Defense vs. The Pill-Box System

WITH a few days still remaining to close the eventful year of 1917, it is now possible to consider the military achievements and methods of the past twelve months in retrospect. In this connection the pill-box system of defense employed by the Germans during the past twelve months stands out as one of the striking features of the war on the Western front, and while it is true that the subject was discussed at length in these columns some months ago, the complete returns now in hand permit of drawing an interesting comparison between the old trench system and the 1917 "flexible" system of German defense.

Aerial supremacy and preponderance of gun fire which rested with the Entente forces during the Battle of the Somme convinced the Germans that the old-style system of seried lines of trenches was no longer an efficient means of defense. Given the freedom of observation and a great concentration of artillery of all calibers, the French and British forces time and again obliterated the German front-line trenches, killing, maiming, and burying the occupants under a shower of steel and high explosive. Even the most pretentious forms of dugouts and subterranean camps intended for the protection of the trench defenders proved vulnerable to Allied artillery; and if these remarkable underground works survived the preliminary bombardment, they only served to imprison their garrisons when enemy troops found their way to the entrances.

It came about that the Germans were confronted with two alternatives: either the dugouts had to be avoided and the trench defenders left to shift for themselves in the open, trusting to luck that the artillery fire would spare enough of them to repel the enemy infantry, or the trench defenders had to be protected in deep dugouts, again trusting to luck that no direct hits would be registered on these concealed shelters, and that, following the preliminary bombardment, the underground garrisons could rush out with their machine guns and check the oncoming infantry.

But the Allied forces introduced the progressive barrage fire, which consists of a curtain of exploding shells which moves a few hundred feet in advance of the infantry waves. Keeping close behind the barrage fire, the British or French infantry was astride the German trenches and dugout entrances before the German garrisons had an opportunity of emerging. Of course, the success of this maneuver depended entirely on how close the infantrymen could keep to the exploding shells without danger to themselves; for given sufficient time between the passing of the fire curtain and the appearance of the infantry waves, the Germans could emerge from their deep shelters and give battle on equal, or more than equal, footing.

Aerial supremacy, which made possible the laying of accurate artillery fire on the plainly delineated German trenches; preponderance of artillery, which made possible the obliteration of trench systems and the destruction of defenders; perfected barrage fire, which kept German dugout garrisons below ground until it was too late for them to emerge except to surrender—all these factors spelled the doom of the intensive trench system according to the German military leaders.

The early days of 1917 witnessed a new system of defense which the Germans sometimes refer to as the "flexible" system, and the British as the "pill-box" system. Instead of a series of parallel trenches connected by communication trenches, in their campaign of this year the Germans have made use of large numbers of isolated concrete blockhouses scattered to a considerable depth over the territory to be defended. Reserve troops for launching counter-offensives are kept several miles in back of the pill-box or defensive area, starting with feeble forces nearer the enemy and gradually increasing the numbers until whole divisions are held in readiness in the villages at the rear.

Theoretically, the pill-box defense is supposed to come out of the bombardment with less than 50 per cent loss. Each pill-box is constructed of reinforced concrete, and nothing short of a direct hit by a big shell can wreck it. The usual pill-box has a garrison of 12 men, and is armed with two or more machine guns, while more powerful blockhouses known as "mebus" are garrisoned by as many as 60 men. The barrage fire passes over the pill-boxes and mebus without destroying any except those directly hit; and with shells dropping at every 30 feet apart the percentage of German defenses left intact to face the infantry is considerable. As the enemy infantry makes its way through the maze of pill-boxes it is subjected to enfilading machine-gun fire from all sides, and becomes weaker as it penetrates deeper. Finally, when it has passed through the defensive area it is suddenly confronted by fresh German troops pouring out from points far to the rear, which overwhelm the weakened Allies.

But in practice the Germans have been sadly disappointed, in some respects at least. While it is true that a fair percentage of the pill-boxes come through the bombardment without damage, their garrisons soon find themselves isolated and besieged by little bodies of especially-trained Allied infantry which are left behind for just this purpose, while the main body pushes on. And although the losses of the attackers are considerable, a surprisingly large number penetrate far enough into the defensive zone to make the gain worth while. Meanwhile the German support troops, not knowing exactly what has taken place if the control of the air does not rest with them, are rather slow in counter-attacking, and when they do counter-attack they are obliged to cover a considerable distance only to find the attackers firmly intrenched and ready to receive them.

The Allies have made it a point in their 1917 offensives to hold their men in check; each attack is clearly worked out and the objectives limited before the men "go over the top." This permits the artillery fire to protect

(Concluded on page 486)

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Comparison of Army and Navy Efficiency

THOSE of us who are familiar with the personality and methods of Rear Admiral Earle, Chief of Ordnance of the Navy, will not be surprised to learn from his Annual Report that the supply of guns, big and little, is keeping pace with the enormous demands of the Navy due to a state of war.

To begin with the capital ships, we learn that the guns for the main and secondary batteries of the dreadnoughts which have recently been completed, or are near completion, are all emplaced on the ships; and that the first of the 16-inch guns for the superdreadnoughts of the "Colorado" class will soon be undergoing tests at Indian Head. Furthermore, our destroyer fleet on the other side of the Atlantic is being supplied with a sufficiency of that new weapon, the depth bomb; and the Navy has placed orders for the full amount of explosives that it will require.

We are told that certain designs of new and advanced types of ordnance of a confidential nature have been carried out. Other new designs which have been completed are those for long-recoil, high-angle, 3-inch and 6-pounder mounts for small craft; and a number of these have been contracted for, the deliveries to commence in September.

The situation with regard to the supply of projectiles is satisfactory; and the fact that the Navy is able to get all that it requires without exhausting the capacity of the firms which have gone into projectile manufacture, makes it surprising that there should be so much talk, these days, about the shortage of such supplies for our new armies.

Admiral Earle tells us that contracts were awarded during the year for all projectiles for which funds were available, the Bureau having made contracts with twenty-three manufacturers, many of whom have not previously made projectiles for the Navy. He says that the almost unlimited capacity of the country for projectile making was indicated when sixty-nine firms bid on one proposal, at figures lower than any previous prices. In spite of the Navy's large demand for shells, there are many large and well-equipped shell plants which are not operating because of lack of orders.

Armorplate deliveries are up to time, and satisfactory progress is being made in providing range finders for various units of the fleet—presumably for the various craft that have been mobilized for patrol work. Fire-control work and developments have progressed rapidly during the last year along the lines which the experience of our Allies in the present war has shown to be necessary.

When the war broke out, in addition to its routine work which was unusually heavy because of the large naval appropriations of the past year, the Bureau had to undertake an extensive program for arming our transports and merchantships. All spare guns from 6-inch, 45-caliber, to 3-pounders for which mounts were available, were tentatively or finally assigned to merchantships; but the supply naturally was quite unequal to the demand, as may be judged from the fact that approximately 5,000 guns were required for this purpose alone. It was realized that the forging capacity of the country was entirely inadequate to meet the demands of the Army and Navy, and it was necessary to initiate new plants into the manufacture of guns and gun forgings.

To this end, the Navy enlisted the services of several firms in the middle West, and gave them every assistance in the way of advice from skilled personnel that could be found. In his report, Admiral Earle names 14 plants which have increased their capacity, or have begun for the first time the manufacture of guns; and these latter will begin deliveries probably about the first of the new year.

As the heavy demand for guns to arm merchantmen and auxiliaries exhausted the stock of reserve mounts, contracts were placed for a large number of these for guns of 5-inch caliber and below. Hitherto, all such mounts had been made almost exclusively at the Naval gun factory and here again it was necessary to work in new firms, which, with few exceptions, have been making gratifying progress in gun-mount manufacture.

Now this record of vigorous and farsighted management in the Navy serves to emphasize the apparent mismanagement which is being disclosed by the Senate investigation of the Bureau of Ordnance of the Army. We refer, of course, to the failure of the Ordnance Bureau to rise to the emergency of our entrance into the war. Whether the fault lies at the door of Secretary Baker or General Crozier, the Chief of Ordnance, will be determined by Congress. The people and the Congress have risen magnificiently to the call of the President. They have offered their lives and their treasure without reserve and with a glad self-sacrifice; and they demand that the Government shall lose not a moment of precious time in turning these millions of men into efficient soldiers, and equipping them with the necessary materials of war.

Yet the Senate investigation was not twenty-four hours old before it was revealed:

1. That the Ordnance Department has not yet furnished a single piece of artillery to the American forces at the front.
2. That the armies now in camp in this country are without artillery, and that they will not get it before next summer.
3. That field artillery for our expeditionary force in France is being furnished by France.
4. That we have today practically no heavy artillery in the way of howitzers—an absolute essential for an effective offensive on the Western front.
5. That although the British armies, after three years experience with an American machine gun (Lewis), have over 60,000 of these in service, we have been experimenting with a new gun (Browning), and, although it has never been tested in the field, have accepted this gun and have incurred all the delay involved in getting ready the gages, jigs, etc., necessary for its manufacture in quantities. Consequently, the Ordnance Bureau will have none ready before next April—twelve months after our entrance into the war.
6. After adopting the Enfield rifle, for the manufacture of which in large quantities our factories were well equipped, due to their turning out several thousand a day for the British army, the Department has incurred many months delay by re-chambering these guns to suit American ammunition. As a result it follows that, should the U-boats, or any untoward circumstance, cut off the American supply, we could not avail ourselves of the British reserve of ammunition, and our troops might face a sudden shortage. The delay, furthermore, will make it impossible to furnish our troops with the new Enfield until they are due to start for Europe.

These amazing revelations bring to mind a passage in an ancient Liturgy, which reads: "We have done the things we ought not to have done, and we have left undone those things which we ought to have done."

The Mecca of Inventors

IN our journeys about the country in quest of everything that is new and interesting, we have of late come face to face with a rather startling condition. Our visits to one field after another have disclosed an unprecedented fund of inventive talent and professional ability, even in industries which have been at a standstill for the past decade in-so-far as technical progress is concerned.

One does not have far to go for an explanation as to why America has suddenly become the Mecca of inventive and trained minds. A war-torn world has by degrees shut off the markets for such men until there remains but one country where new ideas, not strictly in the military line, can still receive a hearing, And that country is the United States. So, for the past 12 months, we have been receiving a steady flow of inventive talent and skilled professionals; and wisely have our industries absorbed these new forces which have already begun to make themselves felt.

Turning from generalities to concrete examples, perhaps no industry is destined to gain more by this influx of men with ideas and experience than the aeronautical. Already we have Italians, Russians, Swiss and French aircraft designers who have brought to us not only the best our allies have to offer, but, in at least one case, the secrets of our enemies, with whom they have worked in other times. At this very moment we have the necessary talent and experience in our midst to build not only Zeppelins, but something superior to Zeppelins. And so it goes with airplanes, seaplanes and every other type of aircraft.

Chemists have come to us from many countries, and have given their valuable experience and ideas, so that we can duplicate and even improve upon the chemical products made anywhere. Lately we have become host to motion-picture experts, among them a cinematograph inventor whose veritable Pandora box of ingenious ideas may still cause a complete revolution in this field. Optical experts, electricians, mechanics, photographic inventors—these and others trained in various branches have found their way into our industrial life.

Never has a nation been so favored; even Germany in the midst of her pre-war greatness never had a more numerous or more valuable gathering of brain power. That our industries and our Government are making the most of this particularly good fortune, goes without saying.

Scientific First Aid for Authors

A LITERARY magazine of large circulation and pretensions latterly published a story by a female writer who appears to be excessively addicted to the habit of keeping commonplace-books. Within bounds the habit is a good one. Indeed, it is almost an essential factor in the business of being an author. You carry about with you a pocket-size notebook, in which you gather a heterogeneous budget of information and ideas, against the day they will come in handy in helping you dazzle the community. When one book is full you lay it aside and begin another, and presently you have accumulated a library of memoranda and memorabilia. Also, you make resolutions from time to time about indexing and cross-referencing the whole collection. If you are a mere compiler of Sanskrit grammars or an authority on the functions of a complex variable, perhaps you actually make the index; but if you have a soul for higher things you don't. Hence when a purveyor of *belles-lettres* to "the highest quality magazine in the world, produced at the highest cost"—candidly so described on its cover—desires to draw upon her storehouse of literary ammunition, she trusts to memory. This dangerous expedient is robbed of its terrors by the conviction that the magazine-reading public is too ignorant to notice mistakes, anyhow.

We deduce that a bygone volume of our author's collection contains a note about the *Pithecanthropus erectus*, something like this: "Ape-like ancestor of man; missing link; useful for antitheses—'from the *P.e.* to Homer (or Shakespeare),' etc." All well and good. Elsewhere, we assume, there is a note on the *Diplodocus:* "Huge extinct animal; dinosaur; skeleton in museum very striking," etc. Correct once more.

Unfortunately for the unwary author there is a pesky hobgoblin whose one business in life is to mix up associated ideas in people's minds. There are several examples of his handiwork in the story under discussion. We are tempted to loiter over our author's description of New York as the place "where so many great forces of a great country coagulate," but withstand the temptation in order to arrive seasonably at something more startling. Here it is:

"At Sixth Avenue, where the great skeleton of the elevated stalks mid-street, like a prehistoric Pithecanthropus erectus." . . .

Alas, poor Yorick! His stature probably differed little from that of the Pithecanthropus (5 feet 8 inches, according to the best information available), but no elevated railway was ever likened to his remains. Perhaps it might have been if Hamlet had been gifted with the defunct gentleman's "infinite jest," or had been a contributor to highest-quality magazines.

All this is prefatory to a suggestion. Reams and reams of paper have been covered with tirades against authors who take liberties with scientific facts, but the evil has not abated in the least. The writers of the tirades derive a certain malicious pleasure from giving vent to their feelings, and their readers are momentarily diverted; but authors of fiction remain impervious to instruction, and editors continue to play golf while the office-boy edits.

The futility of the methods heretofore adopted in dealing with this problem is strikingly illustrated in the case of the much-misplaced moon. Misdemeanors with respect to that luminary are of daily occurrence, not only among authors, but also among painters; and the contumacy of the offenders is almost beyond belief. Particular blunders in this category have been cited so many times that one might suppose them to have become as familiar to the average educated man as the multiplication table. Yet the literary and pictorial moon still displays its crescent in the east and its full orb in the west in the early hours of evening, turns its horns the wrong way, and otherwise defies the laws of Nature.

Evidently new methods are needed. Here is a golden opportunity for somebody overburdened with dollars to start an institution for the relief of suffering purists. Let it be the business of the institution to devote its attention to each offense as it occurs. Protests addressed *ad urbem et orbem* are of no avail. Every culprit must be written to directly. Publicity is not called for, except in the case of hardened offenders. A kindly, helpful letter is the thing, accompanied by a list of scientific primers appropriate to the case.

Perhaps some of us have attempted to perform this service to humanity in our own sporadic way, but none of us has the shoulders of Atlas. A large and munificently endowed institution is the only solution of the problem. Will Mr. Carnegie please take notice?

Automobile

To Prevent Oily Brakes.—In spite of washers and other fittings oil from the rear axle gear case sometimes finds its way to the brakes, through the axle tube, with disagreeable results. It has been suggested that this trouble can be cured by applying a ⅜ elbow into the lower side of the axle tube, just inside the spring fitting, and another into the worm casing, or differential casing as low down as convenient, and connecting the two elbows by a length of flexible metallic tube. This will drain any oil that finds its way into the axle tube back to the gear casing and keep the brake clean.

Motor Trucks to the Rescue.—Owing to the congested condition of the railroads the country is beginning to realize the value of motor trucks for short haul transportation, and even now they are proving the salvation of many manufacturing establishments. That there will be an enormous increase in the numbers of heavy trucks using the highways in the near future there can be no doubt, and this brings up the serious problems of maintaining the roads in proper condition, and also the question whether all vehicles using the roads should not contribute their fair share to the cost of repairs.

A Quick-Acting Jack.—An operation that every car operator detests is the placing and manipulation of the jack, when a tire change is necessary on the road. To dispose of the objectionable features of this tool an English inventor has devised a mechanism that provides for two jacks under each axle, permanently attached, and all connected so as to be operated by a single shank, placed at the side of the car. The gearing is so designed that the car can, in a few seconds, be raised sufficiently to enable a wheel to be removed. A serious objection to the device is its very considerable weight.

A Double Casing Tire.—A Canadian inventor has designed a new tire which is claimed to give better service and better riding qualities than the types now in use. It is based on the theory that the air absorbs the smaller vibrations, but, within certain limits, the amount of air is immaterial. There is an inner layer of fabric, over which is a layer of especially resilient rubber, of varying thickness. Upon this is laid several layers of strong fabric, with any desired form of rubber wearing coating on the outside. By this construction it is expected that the inner fabric will withstand the air pressure, and the outer fabric strength to take road shocks, while the air within, and the interposed layer of resilient rubber combined will form a superior cushioning effect. This construction also permits of the use of sufficient fabric material, so disposed that it will not be injured by the bending all tires are subjected to in use.

Wire and Metal Wheels.—It is predicted that in the near future wood wheels will be displaced entirely by those of metal and wire construction; and this will undoubtedly be a change for the better generally. That wood wheels have survived as long as they have is due to popular fashion rather than to their superior qualities, although they possess many points of excellence. In the early days wire wheels were not as perfect in construction as they are today, but the popularity of the wood wheel was originally the result of an artificially created "fad," artfully worked up by the publicity men in a few factories. Some word artist dubbed the wood construction "artillery" wheels, and the phrase caught the public fancy so strongly that the entire trade followed suit, and it was included in every specification until thoroughly worn out; but the fashion was established, and has clung much longer than circumstances warrant. Now there is a tendency to try something new, and this, together with the increasing difficulty in obtaining suitable wood, is bringing about a widespread change in methods of wheel building.

The Road Track Fallacy.—At verious times the proposition has been put forward to lay flat, steel plate tracks on highways, instead of building full width roadways; and that plan is now being agitated in England, where the roads have been worn out by heavy war trucking and neglect of repairs. A little consideration will show the idea is impossible in practical use. Heavy vehicles, constantly increasing in numbers, would naturally monopolize the track, to the practical exclusion of pleasure vehicles, and even with them the slowest vehicle would set the pace for all. Turnouts for passing could only be used where the traffic runs on a close time schedule, so there would have to be two tracks; which would monopolize any ordinary highway. Even with the most substantial road construction it is impossible to prevent holes and ruts from forming along the tracks, so that the bumps a light vehicle would be subjected toin dodging around a slower one would more than offset any advantage to be derived from the tracks; and without a superior road surface the highway would be impassable for all but the slow vehicles that confined themselves to the track; and a balky motor would tie up the entire track. It is obvious that a practical highway should have a smooth, substantial surface its entire width, and to this the plate track would add nothing in better service, but would greatly increase the original cost and impose great additional expense in upkeep.

Science

Dr. Emil A. Goeldi, whose name is imperishably connected with the splendid museum which he founded at Pará, Brazil, died on July 5th at Bern, Switzerland. He was a Swiss by birth, and was an assistant of Haeckel, at Jena, before he went to Brazil to take a position at the museum in Rio de Janeiro. He founded the institution at Pará now called the Museum Goeldi in 1894. Since 1908 he has been professor of zoölogy at the Cantonal University in Bern.

The Utilization of Horse Chestnuts, although no novelty, seems to have been greatly stimulated in France by war conditions. They are valuable as the source of aesculin, one of the important glucosides; they are so rich in saponin that, crushed, they may be used in place of soap in the laundry; their abundant starch is easily extracted and freed from its bitterness or may be used in the production of alcohol; and lastly, dried and crushed horse chestnuts are a nutritious and wholesome food for cattle and sheep.

Absorption Spectra of Organic Compounds.—The report of the 1916 meeting of the British Association for the Advancement of Science devotes 55 pages to a list of the organic compounds the absorption spectra of which have been measured in the visible or ultra-violet, or examined in the ultra-red, also a list of compounds of which the fluorescence or phosphorescence has been measured. References to the literature of the investigations are given in each case. The list was compiled by a committee consisting of Sir J. J. Dobbie, Prof. E. C. C. Baly and Dr. A. W. Stewart.

Tanned Skins of Aquatic Animals.—Under the direction of the U. S. Bureau of Fisheries tanned skins of various aquatic animals are being prepared for exhibition at the office of the Secretary of Commerce, in order to illustrate commercial possibilities in this line. The tanned and dressed skin of a porpoise, which is already on exhibition, was prepared by a Michigan tanning concern. This material is said to be especially valuable for razor strops. In former years porpoise skin was used to a considerable extent for shoes and other purposes, but of late these hides have been generally neglected.

Acclimation Societies in New Zealand.—According to a consular report from Auckland, there are 29 acclimation societies on New Zealand, engaged in the dual task of protecting the native wild life of the country and introducing and protecting new game birds and animals. The societies are all chartered by the government and are under government supervision. They have introduced into the colony a large number of pheasants of different varieties, California quail, Australian opossums, woodcock, rainbow trout, salmon, etc. The societies pay bounties for the destruction of hawks and other enemies of useful birds and mammals.

Geophysics in Great Britain.—The promotion of geodetic researches in Great Britain formed the subject of an important discussion at the Newcastle meeting of the British Association. The scope of the movement set on foot at that time has since expanded and led to the appointment of a committee for the furtherance of all branches of geophysical research, with the astronomer royal, Sir Frank Dyson, as chairman. The first of a series of meetings was held in London Nov. 7th. Reports and discussions of the committee will deal with geodetic and gravity surveys, terrestrial magnetism, atmospheric electricity, seiches and tides, seismology, the constitution of the earth's interior, etc.

Trinitrotoluol Poisoning is one of the greatest dangers to which munition workers are subject, and much interest therefore attaches at the present time to the conditions under which such poisoning occurs and the precautions that should be taken against it. A comprehensive paper on the subject, by Dr. J. W. Schereschewsky, published in *Public Health Reports* for Nov. 16th, deserves general distribution in the industry concerned. In loading shells with this substance there is constant opportunity for nearly everybody connected with such work to become the subject of chronic poisoning through either the fumes or the dust of the substance. The explosive is generally introduced into the empty shells in one of two ways: the powdered substance is pressed into the shells by power presses, or molten trinitrotoluol is poured into them. The latter method is the more common and the more dangerous to the health of the workers. The poison is readily absorbed through the skin or it may enter the system by way of the respiratory tract. Young people are especially susceptible to its effects; no worker under 21 years of age should be employed in processes bringing him into concontact with it. A complete suit of overalls, fitting closely at the neck, wrists and ankles, gloves, and a cap covering the hair, should be worn by all workers. Men should keep their hair short and be clean shaven. Overalls should be laundered weekly. The eating of lunches and keeping of food in workrooms should be strictly prohibited. Lastly, there should be rigid supervision of all workers by a competent physician, familiar with the symptoms of poisoning and the precautions for preventing it.

Industrial Efficiency

What Does Alcohol Cost the Laborer?—A large manufacturer recently protested against the relicensing of saloons in his town on the ground that the average loss of wages on account of drinking had been $180 per man during the past eleven months, and that the total loss for this town could be conservatively estimated at $100,000 per year at least. The management arrived at those figures through a study of the record of 100 men, 50 of whom were average drinkers and the other 50 total abstainers. Injuries were more frequent among the drinking class.

Increasing Interest in Hides of Sharks and Porpoises.—As a result of the policy adopted by the United States Bureau of Fisheries of furnishing the skins of sharks and other fishes to persons who wish to experiment with these products, more than 40 tanners have had an opportunity to give them a trial, and several companies are now in the market for the hides of sharks and porpoises. Some cabinetmakers in this country still use the skins of certain sharks for polishing purposes. The skins that heretofore have been used are those of one of the European sharks. The Bureau of Fisheries is now determining whether the skins of some of the sharks on our coasts are not equally well suited for this purpose.

Why Not Standardize Shoes?—Obviously, the cost of shoes would be materially lessened if they were made according to a few standardized designs. In this direction the French government leads the way, for in the *Journal Officiel* of August 14th there appears an ordinance providing for the manufacture of a uniform type of shoe that could be offered for sale at a comparatively low price. The ordinance provides that the Ministry of War should, so far as possible, supply with leather the shoe manufacturers designated by agreement with the Minister of Commerce. The manufacturers thus selected must undertake to make shoes conforming to models furnished by the Minister of Commerce, and to furnish them to shoe dealers, under the name of "national shoes," at prices fixed by the Minister of Commerce. The shoes shall be marked as "national shoes" and shall be stamped with the maximum selling price to the public, as well as the name of the manufacturer.

We Must Learn to Pack for the Export Trade.—In the course of surveying damaged American cargoes to which objection had been raised at Rio de Janeiro, the American Consul General's attention was called to the manner in which certain shipments of tin plate arrived at the Brazilian port from the United States. In two shipments which were recently examined, one consisting of 2,000 and the other of 450 cases, 600 cases were found to be damaged in the first instance, and 113 in the other. Tin plate arrives from the United States in lots of 112 sheets, which are packed in cases of very thin wood, only slightly hooped with light iron bands. This does not provide protection against rough handling while cargo is being discharged, and often a case is broken, and the sheets it contains are bent, rusted, or otherwise made unsalable. In the two instances cited the number of cases damaged was well over 25 per cent of the total. The surveyor in this case, Mr. Charles Filiberti, suggests that sufficient protection against such accidents could be provided by running an additional band or hoop of soft iron around the center of each case and thus preventing the boards from coming apart. It would seem safer if the cases themselves were made of a heavier, stronger wood. At any rate, we Americans must learn to pack goods properly for oversea shipment if we intend to get our share of foreign trade.

How Denmark is Saving on Illumination.—The government commission in Denmark that has been investigating the acetylene lamps offered for sale, after having refused sanction to several hundred because of the danger of explosion, has finally discovered some models that are considered safe and has now approved a large number. This method of lighting will now become general as soon as arrangements can be made to import from Norway and elsewhere enough carbide to supply the country, especially for people who have no gas or electricity or kerosene. It is estimated that 200,000 acetylene lamps are now in process of manufacture. Greenland whale oil is being tried for lighting. Usually it is very smelly and smoky, but it is thought some new and satisfactory types of lamp may be developed. At the current price of this oil a two-candlepower lamp would cost about one cent per hour to burn. Kerosene for lamps is now rationed to people who have no other lights at the rate of half a gallon, and at a price regulated by the government at 72 cents per gallon. Theaters and restaurants must close by 10 P. M. to save lights. The distillation of all kinds of alcohol except for industrial uses is prohibited. A large part of the available alcohol will be needed for burning in the new incandescent lamps. It is estimated that one-third of the normal production will be sufficient for all except portable purposes, and it is estimated that 2,000 tons of grain will be saved.

Photographs copyrighted by International Film Service

Remains of the Richmond railroad yards which were blown to bits by the explosion. The yard was crowded with freight cars. One of the ships thrown up on the shore by the force of the blast is shown in the photograph

Survivors of three families and all they saved from the fire

The tent city on North Common in which the homeless are housed

Looking toward Dartmouth. The stranded "Imo," which rammed the munitions ship may be seen at the extreme left of the picture

Wreck of the Grove street church which was levelled by the explosion. By some freak the steeple was left standing intact

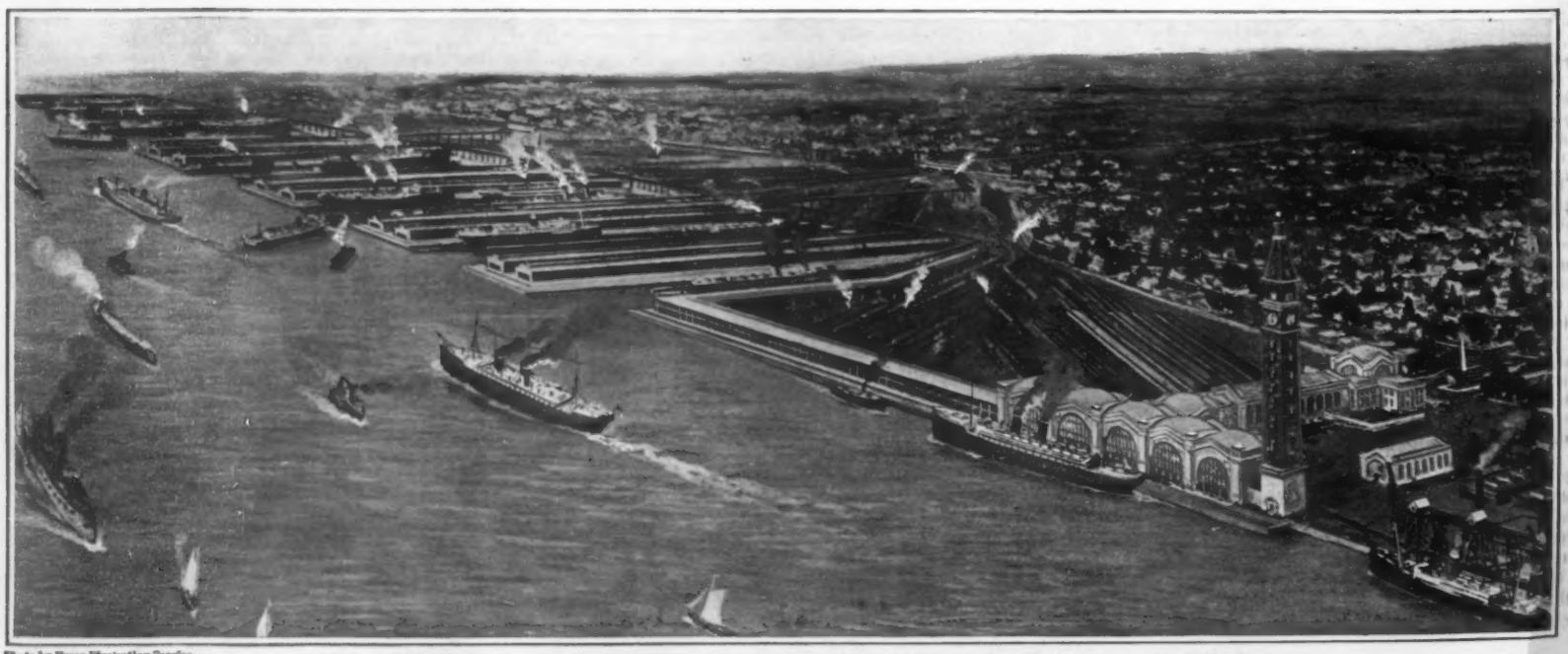


Photo by Press Illustrating Service

The new Halifax dock system, the largest docks in the world, which was untouched by the great explosion

THE RUIN OF HALIFAX WROUGHT BY THE EXPLOSION OF THE MUNITIONS SHIP "MONT BLANC"

Recording Sound on Motion-Picture Film

A Simple Method of Synchronizing Sound Waves and Images in Talking Pictures

A CLEAR, stereoscopic, flickerless image on the screen, in natural colors, accompanied by a true and convincing reproduction of the sounds emitted by the subjects appearing before the eyes, the successive images and sound waves being in perfect synchronism—that, in brief, describes the eventual goal of cinematography. In other words, absolute realism is the ideal; and everything which does not quite come up to the ideal is but temporary and can only serve as a milestone in the steady progress.

Making a talking motion picture. Note the microphones which are placed about and the receivers worn by the cameraman to "listen-in"

Inventors cannot be accused of not having devoted sufficient thought and energy and resources to the talking picture, which, after the natural-color motion picture, has received perhaps the greatest amount of attention. Given a more or less perfect means of reproducing life on the screen and a more or less perfect means of reproducing sounds, inventors in almost every country have endeavored to couple up the projector and the phonograph. But the problem, simple as it appears at first, is a most difficult one; for one thing, there is the question of evolving suitable means of synchronizing the pictures and the sounds, for it is obvious that they must be kept in step. And even if this question is satisfactorily answered, the amplified sounds from the conventional phonograph are far from realistic. Lastly, how is one going to secure a continuous record for a film 1,000, 2,000 or even 5,000 feet long?

The world can expect much from a man who has made a careful and persistent study of motion pictures since 1867, or long before motion pictures were in a more substantial form than mere dreams. Such a man is Eugene Lauste, who, as a boy in France, conceived a means of projecting animated pictures. At ten years of age he took a paper strip from a Zoetrope, or "Wheel of Life," and soaked it in oil so as to make it transparent, after which he passed the pictures through a crude magic lantern, one by one, covering the lens each time he jerked the strip to the next picture. The results were necessarily inartistic, but nevertheless they embodied the true principles of present-day cinematography. Then and there young Lauste decided to follow his idea through, and, in truth, he has made it his life work.

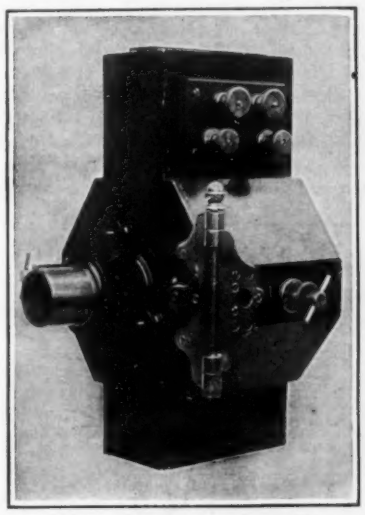
In tabloid form Mr. Lauste's work runs about as follows: From 1886 to 1892 he was with Thomas A. Edison, first in New York and then at the laboratory in Orange, N. J., aiding in the early motion-picture experiments which gave birth to the Edison kinetoscope. Later he went to the Eidoloscope Company and then to the Biograph Company, and worked the elephantine cameras and awe-inspiring projectors of the late 'nineties. Then he went abroad, coming back for a brief visit in 1913 to aid the motion-picture exhibitors of America in their fight against the payment of heavy royalties; and his testimony regarding the famous "loop" patents was instrumental in freeing the industry.

The foregoing history, while somewhat apart from the main subject, is necessary since it gives weight to Mr. Lauste's present achievements and his prophecies regarding the future. He has recently returned to America and is now at work on a talking-motion-picture system which is as interesting as it is novel.

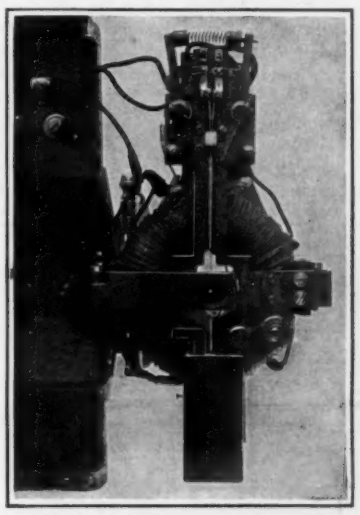
The Lauste talking picture system replaces the usual phonograph with a photographic method of recording sound, and a selenium cell and telephone system for getting the sounds from the photographic record. No stylus of any kind is used; in fact, there a e no mechanical movements used in reproducing the sound, other than the constant moving of the film in front of the selenium cell. The sound waves are said to be reproduced with utmost fidelity; and since they are placed on the same film as their corresponding images, the synchronism between the two is absolute and rigid. Furthermore, the sound records can be made in any length, just as motion-picture films can be made in practically any length.

In making a talking picture of a scene by the Lauste method the players are not obliged to talk into a horn, as is customary when phonographs are employed. Sensitive microphones are distributed about the scene, either out of range of the camera or suitably camouflaged, to record the sounds; and the players not being constantly reminded by huge horns that they are being "registered" for utterances as well as for actions, are naturally better able to do full justice to the respective rôles.

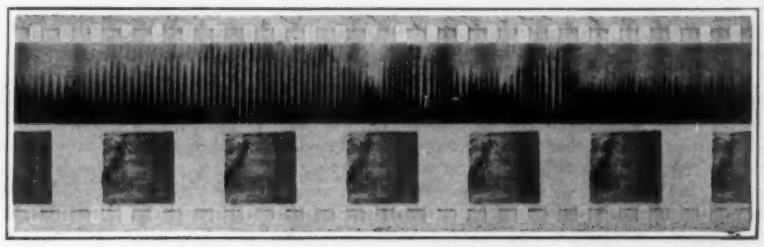
The sound waves, impinging on the microphones, are transferred to a circuit which includes a storage battery and a highly sensitive string galvanometer. The string or wire of the galvanometer is suspended in the field of powerful electromagnets, and the slightest fluctuation in the current passing through it causes considerable distortion. A beam of light from a powerful arc lamp rigidly mounted at the rear of the camera, passes through the galvanometer and, in a greatly magnified form, throws a shadow of the wire on the steadily moving film behind a narrow horizontal slot. The wire being so arranged that one side of the exposed film is always in the shadow, the developed film shows a straight edge and a series of "peaks" quite suggestive of a profile map of a mountain range.



String galvanometer for making sound records



Mechanism of the sensitive string galvanometer



A strip of negative talking-picture film, with the sound record above and the picture images below

The camera for making talking pictures is of necessity much larger and more complicated than the standard apparatus, for it must record the pictures and the sound waves at the same time. The front part of the camera is devoted to the usual camera mechanism, while the rear includes the arc lamp and the galvanometer. The movement of the film through the camera is intermittent, at the rate of 20 images per second, while through the sound-recorder member it is continuous, and for this very reason it is not feasible to reproduce images and sound records side by side. However that may be, Mr. Lauste hastens to assure us that this is no disadvantage in practice, and that even when splices are made in the film the synchronism is not noticeably affected.

The galvanometer is the heart of the sound recorder, hence the inventor has given considerable attention to its design. In the earlier form he used a single wire which made a record similar to that shown in the accompanying strip of film. The upper part of the wire passes through an oil bath, so that its movements are dampened to the required degree. Means are provided for opening the instrument and readily replacing the wire should any harm befall it, and since the wire has a natural period of its own which has a marked effect on the fidelity of the sound record, Mr. Lauste provides adjustments for altering its natural period.

In a more recent form of galvanometer two wires are used. When current passes through them the usual parallel arrangement is disturbed, and they move away from each other in direct proportion to the strength of the current. The resulting sound record is a double row of "peaks," with the points facing each other. Presently the advantages of the double row will be discussed.

Given a film of varying intensity, or of constantly changing proportions of opaque and transparent sections, one has but to pass it continuously before a selenium cell in order to vary the strength of an electric circuit in which is included a telephone receiver. At least, so runs the theory; and in practice it is the same except that certain difficulties have to be met. Mr. Lauste first passes his film through the usual motion-picture projector at the rate of 20 images per second instead of the usual 16, and then in a continuous movement through the sound-reproducer.

A strong source of light is gathered into a sharp beam and projected through the sound-bearing section of the film and upon a selenium cell. In the present apparatus a remarkably sensitive selenium cell which has a range of resistance of from 1,000 to 100,000 ohms, is used, and this has much to do with the faithful reproduction of the sounds. As the film is rapidly moved in front of the selenium cell, the resistance of an electric current passing through it is altered in proportion to the amount of light falling on the sensitive material, which, as is well known, has the property of changing its resistance according to the degree of illumination.

With a single row of sound "peaks" it was found that only a small portion of the selenium cell was called upon to do the work, the other portion being always in the shadow. By using two rows

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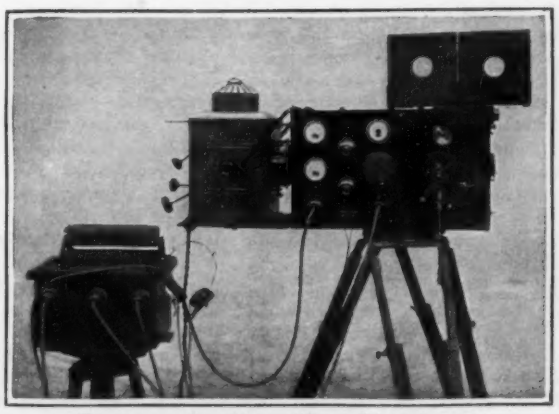
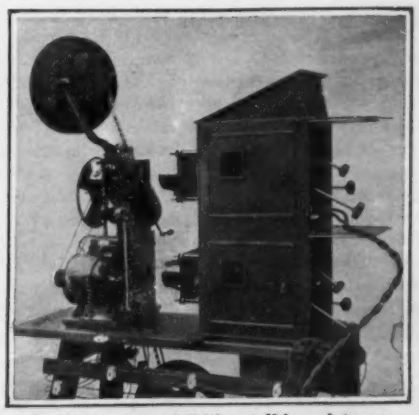


Camera employed in making talking pictures



Projector for exhibiting talking pictures

The Battle Control for the Rifle

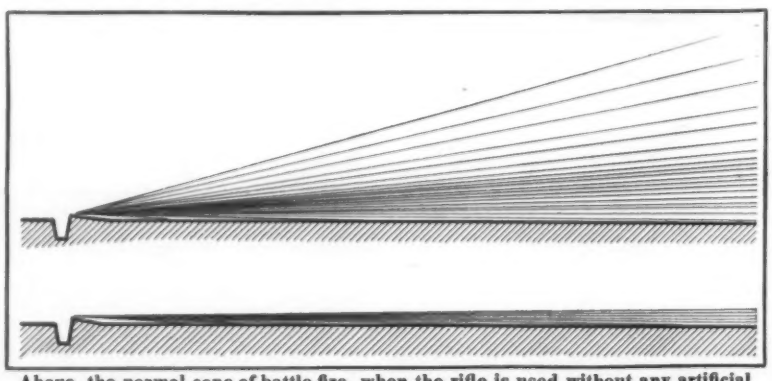
A Neglected Means of Increasing Infantry Efficiency Many Fold

THE inefficiency of massed rifle fire at fairly close range has been a matter of observation and comment ever since battles were first fought with bullets. It seems that no amount of preliminary training, no possible adjustment of battle sights, can eradicate the inborn tendency of the race to hold a rifle too high when working under the slightest stress. The disintegrating effects of battle conditions are widespread; nowhere are they more real or more disastrous than in their influence upon rifle fire.

That the difficulty really is one of holding the rifle too high is clear from the most cursory compilation of authorities. Uniformly the statement is made that fire at long ranges was effective, while at shorter distances it became less and less so. Alike in the Franco-Prussian War, in the Crimean campaigns, and in the Russo-Japan conflict, it was found again and again that losses from rifle fire at ranges well above a thousand yards were serious, while from five hundred yards down they were remarkably small, sometimes ceasing altogether. Thus, at Beaugency, in 1870, a French battalion fired at close range for half an hour at a German company lying down; and the net result of their efforts was one man hit!

As the last word in proof of the point, we may cite the record made by the Boers at Colenso. Conditions here were favorable beyond any reasonable expectation. The Boers were skilled shots, the action was fought in full daylight at ranges under a thousand yards, the Boers were not under a severe fire, and their enemies were thoroughly out in the open and exposed. Yet with all these advantages, the best the Boers could do was one hit in 600 shots fired; and so far as we can discover, this is the world's record for accuracy in battle fire! The law of probabilities makes it certain that if the Boers had had the proper angle of fire they must have done better than this.

It is at the short ranges that the fiercest fighting occurs, and it is here that battles are won and lost. Formerly one of the first requisites for a good infantry position was an open field of fire, several hundred yards in depth. But the searching power of high explosive shells fired in great volumes has forced infantry to seek cover from vision in order to gain cover from fire; it must hide during the terrific shelling and be ready to repel the assault that follows. Often a hundred yards or even less is the greatest depth of fire attainable; and since an assault will cross so short a space in a very brief time, it is obvious that the defense must make every shot count. The failure to do this with the rifle has led to the new vogue of grenade and bayonet—the one to give a fire effect certain to lie close to the ground, the other as a necessary last resort in view of the uncertainty of fire.



Above, the normal cone of battle fire, when the rifle is used without any artificial restraint. Below, the deadly concentration resulting from Colonel Ely's fire-control device

Now bayonet and grenade are good weapons in their place; and they have, in modern warfare, a very definite place. But is the failure of the rifle a final one? Certainly this arm possesses potentialities of long range destruction which are not inherent in the grenade, even more emphatically not in the bayonet. We have recently heard a tale of a clash between small forces of British and German soldiers in the open, at a range of a hundred yards. The Germans turned and fled; the British, armed with loaded rifles, fixed bayonets and frantically pursued the Boches, endeavoring to come within bayoneting distance, or at least within grenade range. The possibility of shooting the fleeing enemy never occurred to them, so far have they got from looking upon the rifle as a shooting-iron; in their hands it is nothing but a handle for a bayonet. And presumably if they had opened fire, they would have shot far above the heads of their foe. Their failure to realize the possibilities of the rifle, inspired by traditional ill success with it, put it out of their power to damage an enemy at this ridiculously short range. Surely this has gone far enough; and it is time to call a halt. As a first step, we may well inquire whether it is not possible to overcome in some way the tendency to hold this arm too high.

Colonel Frank D. Ely, of our army, has for years been engaged in a constant but losing endeavor to interest the ordnance officials in a device which he claims will do just this. Its mechanical features are of no great import here; enough to say that it is an attachment to be put on the rifle, which will add but two ounces to its weight, which is fool proof in every respect, and which makes it impossible for the rifle to be discharged when held higher than a given angle. It is not rigid; that is to say, the angle at which it permits fire is controlled at will by adjusting the device. Accordingly, it can be used at any range, and even for shooting up hill or down hill. This adjustment is the work of but a moment, and so simple that any man who can learn to shoot a rifle at all can certainly learn to do this also. Colonel Ely calls his invention the battle control, and has got out a little pamphlet in its behalf, from which we borrow the diagrams on this page.

The normal cone of battle fire is as shown in Figure 1. The vertical dispersion is enormous—even greater than one would be led to suppose from the bare statements already made as to the inaccuracy of battle fire. It was actually demonstrated by Wolozkoi that the mean of fire—the average elevation at which the soldiers will hold their rifles—is about four degrees. For the modern rifle this elevation corresponds to a range of some 2,200 yards. Any hostile force inside this range is comparatively safe, the fire passing well over it and beyond. The function of the battle control is to flatten this cone, bringing it close to the ground as in Figure 2. Every bullet in this flattened cone has a continuous danger space throughout its path; it may not meet a hostile soldier but it can miss him only by going between him and his neighbor, never by going over his head. It makes its strike on the battlefield, instead of a mile away.

The battle control is a simple mechanical improvement in the lock of the rifle which absolutely prevents discharge if the rifle is held too high—which is to say, if it is held above the angle for which the control is set after the range has been determined. The rifle simply cannot be fired until the aim is properly lowered and the trigger pulled again. When this correction in aim has been made, the control causes not the slightest diminution in the volume of fire that can be delivered. There is no change made in the existing methods of sighting and firing; all the control does is to prevent the shots which would be wasted, and force the rifleman to fire at the proper range. Nor does the device interfere with the normal use of the rifle; for it can be set "on" or "off" at will, and when "off" has no function—the rifle is then the normal rifle.

It is not even necessary to take Colonel Ely's word for it that the control is mechanically satisfactory. Mechanical experts, civilian and military, including the present superintendent of one of our greatest arms factories, have passed on it and pronounced it O. K. in this respect. So the only questions which can be considered as at all open are its performance in increasing the effect of fire, and the desirability of incorporating it in the army rifle.

Colonel Ely himself has covered the first of these points. He has shown us the records of a test made with blindfolded riflemen—blindfolded in order that no opening might be left for a claim that the results achieved were due to aiming, and that accordingly the comparison should be with target practice rather than with battle fire. These blindfolded men shot at a single row of 25 kneeling silhouette targets; and they scored four per cent of hits. It requires no great knowledge of higher mathematics or ballistics to deduce that this showing is 24 times as good as that of the Boers of Colenso—which was the best previous record for fire under battle conditions.

So much for performance; and our preliminary remarks have certainly demonstrated the need for a device of this character. The only question left to answer is "Why has not this device been adopted and incorporated in our service rifle?" One reason is that after a trial at the School of Musketry at Monterey, the Director, while admitting in his report all the advantages claimed for the control, recommended against its adoption because it was "not an instrument of precision"—precision being the hobby of this school. Such a remark, if it possesses any meaning at all, can only mean that the whole purpose of the control escaped the understanding of the men who had its fate in their hands; for of course it is not an instrument of precision. It does not claim to be one. The sight is an instrument of precision, and it is enough in this direction; if a soldier won't or can't use one instrument of precision to advantage, he certainly won't use two instruments of precision. The fire control is not intended to supersede the sight, as the worthy director perhaps feared: it is merely designed to supplement the sight, and to control the fire when effective use of the sight alone is out of the question.

This wholly inadequate report has so far operated to seal the fate of the battle control. Whenever the subject is now put forward, the Ordnance Bureau refers to the Monterey test as conclusive and satisfactory to it; occasionally descending to the good old plea, "if the infantry wants this control, why don't they ask for it? We will build anything the infantry wants." This of course, is begging the question altogether; for how can the infantry say whether it wants a thing which it has never seen, but knows only from hearsay?

Until the Ordnance Bureau builds enough rifles equipped with the control and issues these for a thorough demonstration and test by a thoroughly representative board of infantry officers, the infantry will certainly not ask for it; and until the infantry asks for it the Ordnance people won't build it; so the matter is plainly running around in a circle like a kitten chasing its own tail, and can never reach any point outside the circle.

Mauled and smothered by the artillery, with her prestige threatened, the battle control appears to be the infantry's answer—and a fitting one—to what has become an intolerable situation of blindness under deluge of shell and smoke and gas, of comparative vulnerability to attack in storm or darkness. The battle control meets all these difficulties by sending the bullets of the infantry along a straight line close to the ground, in which they can meet and stop anything that lies between the beginning and the end of their path, instead of sending them in a curve which only comes low enough to do damage at the point of descent—and in which that point of descent is usually far behind the supposed objective. Shall lack of intelligent investigation, requiring little time and little expense, keep us from gaining a tremendous superiority of fire over the enemy?

Zeppelin, Aeroplane and Parachute

The Present Status of War by and on the German Dirigible

By Carl Dienstbach

AFTER an interval of several months during which England has been free from the overhead menace, the death of Count Zeppelin has seemed like a signal for the renewal of the attacks which his genius made possible. In view of the fact that in the last raid preceding this hiatus several of the German craft were burned, it would seem that the Kaiser's engineers were considering means of better protecting their air raiders from this fate before again risking them in attack. But once more one of the invaders is reported burned, this time near Paris. Evidently both attack and defense in Zeppelin warfare have made vast progress with the past two and a half years.

In the first place, the Zeppelins have sufficiently increased in size and speed to carry efficient loads of fuel and bombs at a minimum fighting altitude of 10,000 feet. What protection such an elevation affords is best understood by reference to an experience at the Sheepshead Bay Race Track early in 1910, when there was much interest in the possibility that some of the competing machines might set a new altitude record of 10,000 feet. Arriving late on the last day of the meet, the writer feared that it had already closed, an empty blue sky extending above the track as far as the eye could see. But inquiry brought out the fact that the altitude contest was even then in progress; and with the kind assistance of some earlier witnesses several tiny specks were finally made out in the dazzling blue. These flyers, certainly not easier to find than stars of the fifth magnitude, did not in any case attain an elevation in excess of nine thousand feet. Similarly, notwithstanding its exaggerated dimensions, a Zeppelin at two miles is little more than a gray dash.

In the beginning the Zeppelin was limited to low altitudes simply through the inertia of the human mind. It was cheaper to carry more load on a smaller ship; and under these conditions the sluggish rate of progress robbed the motor of its true lifting force. But extreme fighting altitude fits the Zeppelin far better than it does the aeroplane. The latter, indeed, thanks to its modern speed and power, can reach with comparative ease any altitude accessible to the former; but once it gets there it is comparatively useless as a military agent, because it cannot see. The violent vibration of the craft, due to the fact that it is "all motor"—the obstructions offered the field of vision by the deep cockpits and the surrounding parts of the machine—the goggles made indispensable by exposure of the head to the terrific icy hurricane—the cramped space—the deafening noise, making

(Concluded on page 485)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Foucault's Experiment

To the Editor of the SCIENTIFIC AMERICAN:

Foucault's pendulum experiment has been recently repeated by me under circumstances that I consider rather favorable and with apparatus somewhat unusual.

The place is the rotunda of the post-office building in this city, the wire wedged into a small hole in the iron tread of the steps near top of dome and extending through the floors to the second floor level. The wire was No. 12 gage galvanized steel and the weight was a cast-iron ball turned true on a lathe and nickel-plated. The weight of ball is 41.75 pounds and the length of pendulum 121.78 feet. Starting six feet off center the ball would swing long enough to cover an arc of 15 degrees. The rotunda was without air currents and every care was taken to start the ball without side motion but this, it appears, is difficult to do. Although being apparently still when starting, the ball after a few minutes, would describe a flat ellipse amounting in 15 minutes to perhaps one degree of lateral motion. The true reading was assumed to be the mean of the forward and backward swings.

The results obtained corresponded fairly closely with what I expected. The latitude of Kansas City, as determined by the experiment is 38 degrees 20 minutes. The true latitude is 39 degrees 5 minutes, a discrepancy of 45 minutes. This was the average of several different trials. The apparatus excited much comment among visitors to the building and many were the guesses as to what the apparatus was used for.

As you are, no doubt, familiar with the experiment I would like you to give me the following information:

1. Is it possible to get the ball to swing with no deviation in the forward and backward movements? It did not seem possible to do so in these experiments.

2. Would you consider the apparatus and circumstances under which it was used to be equal to the general average or above it compared with experiments with which you are familiar?

3. Do you consider the results obtained, with respect to determining latitude, good or bad under the circumstances?

W. N. COLLIER.

Kansas City, Mo.

[It is possible to get the ball in the Foucault Experiment to swing in a line without changing to an elliptical orbit. The wire must have an equal pressure on all sides and the support must be rigid. We suspect that the iron tread of the stairway yielded slightly as the ball swung to and from. We consider the mathematical results very good indeed. The apparatus is equal to that ordinarily employed for a popular exhibition of the phenomenon.—THE EDITOR.]

The Tell-Tale Net

To the Editor of the SCIENTIFIC AMERICAN:

In answer to Mr. C. H. Woodward of San Diego, Cal., in issue of November 17th, I will give my idea of the most practical use for the tell-tale net. It should be made in units of 60 feet long by 200 deep, and by inserting the weights in bottom bamboo stretcher, it could be rolled upon the stretcher and carried on destroyers, patrol boats, merchant ships, transports and aeroplanes to be dropped the same as the depth bomb is at present. When submarine's presence is known the net would unwind itself after being thrown overboard, but its most practical use would be in fastening the bamboo floats to a line between patrol boats in areas where submarines have to be submerged. On striking one of the units it would tear away from the bamboo floats without the submarine being aware of it. One boat would give chase and wireless for another boat to replace net and take her position. The net having little weight would not cut, with only resistance of buoy against it.

LEWIS B. SHADER.

Union Hill, N. J.

The Case for Esperanto

To the Editor of the SCIENTIFIC AMERICAN:

In your current issue, under the head of "Science and the International Language," you present an interesting but indecisive discussion of the subject, in that you fail to see and state its obvious conclusions. Every one recognizes that national jealousies, or "patriotism," render impossible the selection of any national tongue as international, and you well present the case against the employment of Latin. But the real obstacle to the use of any of them is that their acquisition is too difficult and time-consuming. It is not merely the asinine perplexity of English spelling, the stupid purism of German lexicography, the intricacy of the French verb, that makes the difficulty, it is also their multitude of idiomatic turns of speech which render them impossible to all but a comparatively few who are impelled by private interest or special aptitude.

This being admitted, what is left but recourse to an artificial language? The fact that a language is the invention of an individual certainly cannot, to one who thinks to good purpose, militate against its employment as an international language if it possesses the qualities which fit it for such use.

You say, "When an auxiliary language is adopted, it must be one which satisfies all international needs, and not merely those of the learned world." Now the writer claims that Esperanto, whose use in the military prison camps of Europe gives occasion for your article, meets every requirement you demand in an auxiliary language. It is wholly sufficient as a means of literary expression. Its vocabulary contains in itself the means of expansion to meet the requirements of every department of science, and its scientific literature is already extensive. It is as flexible as Greek, as precise as French, as harmonious as Italian. And it is wonderfully simple in its construction. Its whole grammar can be learned in an hour, and a working vocabulary for all ordinary needs of conversation and correspondence can be acquired in a few weeks. Exceptions to grammatical principles, which so perplex the learner and levy such a tax upon his memory in studying a foreign language, do not exist in Esperanto. Its vocabulary, instead of being artificial and arbitrary, as in Volapük, is wholly Indo-European, so that any European, including, of course, English-speaking people, already possesses more than two thirds of it in his own tongue. In short, Esperanto is the creation of supreme linguistic genuis.

You remark, "Some of these manufactured tongues are marvels of ingenuity, but somehow they do not seem to fit the human brain. Natural languages grow up in consequence of complex laws, which are only imperfectly known. Apparently these laws are too strong to be set aside in behalf of simplicity and regularity."

If you will pardon the remark, the applicability of this statement seems obscure. We learn our native tongues by unending practice from babyhood. The tendency of language is always toward simplification, and toward logical precision. Compare English or Swedish with their mother Gothic, or French and Spanish with Latin, or modern with classical Greek. Every one who actually employs Esperanto in speaking and writing is soon aware that it is as instinct with soul and life as any other tongue, and no "complex laws" cloud his mind in using it. He uses it with a correctness and assuredness that he can never attain with a foreign "natural" language.

You might equally well argue that the human brain would suffer by the introduction of a reasonable amount of correspondence between English spelling and English pronunciation. Our spelling has grown up "in consequence of complex laws which are only imperfectly known," and which appear too strong to be set aside in behalf of simplicity and regularity. And yet there are learned, sensible men who claim that these "complex laws" are merely displays of ignorance, sentimentality, and mulish conservatism, and that there is really nothing in the construction of the human brain which should render it impossible, by the adoption of sensible spelling, to save our childhood the enormous burden of learning the present orthography of the language. Your argument against an artificial language seems to smack of the conservatism which upholds our present spelling, and which has so often in the past antagonized new, world-transforming inventions.

Without dwelling upon your erroneous assertion that Esperanto was on the wane before the war, and gratuitously admitting that during the present world-convulsion it may be little in men's thoughts, you may be assured that it is still alive, and has its numerous adherents in this country, as well as in the prison-camps of Europe; and the prospect is that after the end of the war it will enter upon a steady upward progress.

The argument of your article leads logically to the conclusion that there is no remedy for the present difficulties of international intercommunication in scientific or other fields. From its inception its proponents have maintained that Esperanto is such a remedy. Would it not be more worthy of a great journal like the SCIENTIFIC AMERICAN, instead of conjuring forth misty metaphysical arguments against artificial languages, actually to investigate the correctness of this claim by studying the structure and capabilities of Esperanto, and acquiring some acquaintance with the scope of its literature? I am sure that after such a course the SCIENTIFIC AMERICAN would be ready to acknowledge Esperanto as a thoroughly adequate and beautiful solution of the problem of easy international communication.

ROBERT M. BAILEY.

West Somerville, Mass.

Some Ways In Which Grain is Wasted

To the Editor of the SCIENTIFIC AMERICAN:

In line with the worthy efforts being made to save foods from waste the writer would like to call attention to the fact that it is no exaggeration to say that if it were not for the work of the rats, mice and birds the grain carrying railroads of this country would be compelled to install and operate sweepers to keep their tracks clear of the wheat, the corn, oats and other cereals that leak out over the right of way through the cracks in their defective cars. No car should be allowed to enter into that traffic just now until it has been made grain tight. That does not imply withdrawal of cars or extensive repairs at a time when there is a shortage of rolling stock. Stout paper and glue applied where needed will insure safe transit for one trip at least. The carriers should be penalized for every bushel of grain lost in their hands.

To a somewhat lesser extent but still tremendous in the aggregate is the loss from wagon beds where loose grain is hauled. That form of transportation should be prohibited during the period of the war. Only sacked grain should be hauled.

Penalties should be fixed for the storing of grains in other than rat and mice proof cribs and bins. The amount of good food destroyed or spoiled in this way is enormous in its sum total. A bounty put on rats or their systematic destruction through some form seems a fit part of any food conservation plan.

In every large city tons of oats are scattered over the streets every noon time, spilled from the nose bags of the horses. A better feeding device should be found and its use made compulsory. I understand the Society for Prevention of Cruelty to Animals has just such a thing perfected. Horses would be better nourished and a great saving effected.

WALTER G. PETERKIN.

New York, N. Y.

Making the U-Boat Destroy Itself

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to make a slight addition to the submarine net of Mr. Lewis B. Shader, described in the SCIENTIFIC AMERICAN of the 7th inst. No bomb, no matter what size, shape or weight will slide down the cable once it strikes the water.

Therefore I would suggest the use of a double cable, even thinner to reduce the weight, provided with a pulley at the bottom rod, with both ends attached to the buoy. When the buoy starts to "run," it is then picked up, the bomb attached to one end of the cable, while the other end is held by the chaser or destroyer.

In that way the U-boat herself pulls the bomb which will help her to the right place, while the chaser gets at a safe distance, recovering also the cable.

A. A. VAN REINE.

Brooklyn, N. Y.

Potash from Bananas

To the Editor of the SCIENTIFIC AMERICAN:

During the present agitation against waste it might be a good time to point out a source of saving and recovery of a material for which this country stands in great need, potash.

The fruit of the banana burned to ash gives up 72 per cent of that ash as water soluble potash. The ash from the skins contains about 55 per cent water-soluble potash and that from the club-like fruit-stem about 30 per cent. The City of New York, for example, gathers at least 30 tons of this banana waste each day from the markets and stores, enough to yield under proper treatment 500 pounds of potash at the very least. This does not require any sorting to get, it merely means not mixing it with other vegetable refuse. The big fruit companies have from two to twenty tons of this to dispose of each time a steamer unloads and that is usually three times a week. The burning of this waste need present no difficult problem. The city has several incinerators capable of handling this material, notably at Clifton and West New Brighton, S. I., or it does seem to me that it might be best cared for at the Navy Yard or at Fort Wadsworth where I know they have rubbish destructors.

I am hoping very much that you will think this worthy of publication and you may be able in this way to save this valuable material now, the time when it is most needed.

P. G. W.

New York.

To Our Subscribers

WE are nearing the close of another year—the seventy-third of the SCIENTIFIC AMERICAN's life. Since many subscriptions expire at this time, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Our Destroyers in the War Zone

An Exciting Service Which Calls for Initiative, Courage and Endurance

Signal yard and crows nest

SERVICE on a destroyer at any time, and, particularly in the winter months, calls for the very best that a man has in him of physical, moral and mental make-up. This holds true in the piping times of peace; it is doubly true when the war storm breaks; and it is tragically true in such a war as the present, where the enemy has deliberately transformed himself from a gallant naval officer to a most damnable species of pirate.

In the use of the word "pirate," however, let us give even the Devil his due, and make it clear that such a deplorable sinking as that of the "Jacob Jones" does not come within the definition of piracy. For the "Jacob Jones" was a warship and therefore a lawful object of attack by the U-boat which sank her. German Piracy consists of the wholesale sinking of cargo ships and their crews without warning, and, if possible, "without trace," and the even blacker crime of sinking passenger ships crowded with non-combatant men, women and children.

It is the existence of this piracy and the need for meeting it, which is rendering the destroyer's work particularly arduous and full of risk. The speed of the destroyer is one of her best defenses against the torpedo; but when she is convoying a fleet whose speed is cut down to that of its slowest ship, say nine or ten knots, the risk to the destroyer is greatly increased.

Perhaps the most trying feature of life aboard a destroyer is the excessive rolling to which these craft are subject. It is not unusual, in certain conditions of the sea, for these boats to roll through a complete angle of 90 degrees; and since the period of roll is about five seconds, it can be understood that anywhere in these boats, particularly on the bridge, this swift motion is exceedingly trying not merely to the stomach but to the nerves and the whole muscular system. As a matter of fact, if a destroyer is caught in a gale that lasts, say from twenty-four to thirty-six hours, the crew at the end of that time will be a pretty tired lot and thoroughly muscle-sore. The reason is that where the motions are so lively and continuous, the whole frame of the body is continually under the strain of adjusting itself to ever changing conditions of balance. This continues even at nighttime, when an officer in heavy weather must fairly wedge himself in his berth to keep from being thrown out. Meals have to be taken, in the worst weather, standing up, the food being eaten piecemeal as it is handed through to the wardroom mess from the galley.

Forward gun of U. S. Destroyer

Some years ago, when the writer was on the bridge of one of our destroyers of the 750-ton class, the officers were estimating at what speed the men on the bridge were sweeping through the air as the little craft rolled through 90 degrees (45 degrees each side of the perpendicular) in five seconds of time. Extending the calculation to the lookout in the crow's nest, we find that this man is riding on the arc of a circle at a rate, at times, according to his height above the sea, of from thirty to forty miles an hour.

Except for the forecastle deck, the free-board of a destroyer is quite low, although in the latest ships which are now under construction, this has been raised considerably. Consequently, in certain conditions of weather it is a risky matter to walk along the main deck. Evidence of this is seen in some of the pictures which are herewith presented. Note, for instance, the rough-weather trolley line, which consists of a light cable stretched about six to seven feet above the deck, from which hangs a "trolley pole" in the shape of a length of rope with an eye in its upper end which engages the cable. With a good grip on the "pole," the seaman may walk the length of the deck with some assurance of his not being blown or washed overboard. Another provision against bad weather is seen in our picture of the bow and stern guns. It will be noticed that a square patch of canvas or matting has been stretched upon the deck to assure better footing than could be secured on the steel deck. And, by the way, there is as much difference between gun-pointing on a 1,000-ton destroyer and on a 32,000-ton battleship as there is between duck shooting and shooting at a target on the range—so lively are the movements of the gun sights due to quick motions of the destroyer.

That a destroyer flings water freely in a seaway is also suggested by the photograph of the gun on the forecastle deck, which has been provided with a spray and bullet shield. Similar shields also have been put on the two guns on the main deck just abaft the break of the forecastle deck.

The after gun of a U. S. Destroyer

Photos copyrighted by Underwood & Underwood

Trail of bubbles marking torpedo course

Another element which adds its quota to the discomforts of destroyer life is the rush of air due to the high speed of these craft. Our latest destroyers now under construction, are, some of them at least, to have a speed of 35 knots, which is about forty-one miles an hour. Now, any one who has faced a 40-mile gale knows, especially if there is any spray being carried by the wind, how it will cut the face and blind the eyes. But if the destroyer is running full speed against a 40-mile wind, which she would be able to do before the seas rose to their full strength, it can be imagined what the wear and tear of the wind alone must be in the bitter weather of the wintertime. As a protection against wind and spray the bulwarks of the bridge are curved outwardly and then back to the rail, giving them something of a V-section. Many of our readers doubtless will have noticed the same construction of the bulwarks on the fire-control platform of our battleships. The object of this is to deflect the wind upwardly and over the heads of those who are on duty on the bridge. Further protection has been given by providing hinged windows, as shown in the photograph taken from the bridge itself. The small canvas-covered shelf to the right serves to hold the chart, glasses, megaphone, and other articles which are used by the Navigating officer. For night work in the submarine zone, this shelter is provided with a small hooded lamp; and to prevent the least ray of light from disclosing the presence of the destroyer, a curtain which is normally rolled up at the top of the box, is let down upon the shoulders.

Not the least interesting of these pictures is that showing the greatly dreaded trail of a torpedo. This is one of the best pictures of this kind we have ever seen; for it shows with great detail the bubbles of air exhausted from the torpedo, as they reach the surface. At the beginning of the trail is seen the conning tower of the submarine from which the torpedo was discharged. This picture was taken from a British ship and released by the censor. Whether the torpedo was fired in practice or whether this represents an actual attack the reader may decide for himself.

Controlling the Tension of Airplane Guys

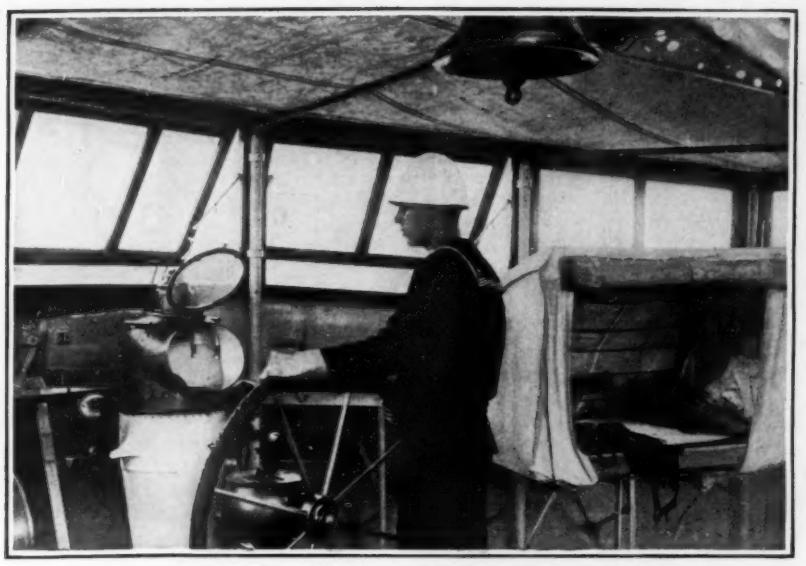
A HIGHLY important feature in airplane construction is the securing of rigidity and symmetry by means of the proper tension in the guy wires. Any imperfection in the adjustment of this tension will cause variation in the incidence of the wings during flight, which will in turn occasion irregularity in the distribution of strains, so that unforseen and dangerous stresses may be produced upon important parts of the apparatus.

In most factories this regulation of tension is performed by expert mechanicians known as mounters. Their work, however, is almost entirely empirical, the main points which they can take into consideration being visible symmetry, the maintenance of a constant distance between the extremities of each guy wire, and the endeavor to adjust the tension to the point found advisable either in practice or by calculation.

Under these conditions there exist current differences of as much as 30 and 40 per cent in the tension of symmetrical guys of the same machine, according to M. Carlo Maurilio Lerici, an electrical and aeronautical engineer who writes in a recent number of *le Genie Civil*. Such differences may well fail to pull the machine out of symmetry as long as it remains at rest; but of course as soon as it takes the air they begin to be felt severely.

M. Lerici proposes a new and more rational method of regulating tension, upon which he has experimented with great success, and which gives results of great precision, though it is so simple as to be easy of application in any factory. This is based upon the use of the frequentiometer for measuring the rate of vibration of wires, referring to the well-known fact that this rate increases with the tension. The writer claims to have simplified the application of this principle to a point that makes it a valid industrial procedure.

His apparatus is composed of a series of steel strips of different lengths, sunk at one end into a block of wood. When one of these strips is held with its free end lightly in contact with a vibrating wire, it exhibits a decided sympathetic oscillation—provided its period of oscillation is equal to that momentarily obtaining in the wire. Further, it is not even essential that the contact be directly between the strip and the wire; it suffices to place the supporting block of the series of strips in contact with one end of the wire. This of course simplifies the work of selection greatly, since a single test will refer the wire to all the strips, where otherwise a separate trial would be necessary with each strip, and since it



Bridge of U. S. Destroyer—Quartermaster at wheel

"Trolley" lifeline and "pole" to prevent men being washed overboard

further makes it possible to distinguish the strip whose period is nearest to that of the guy, regardless of whether any of them are in exact correspondence with it. The multiple of resonances give no trouble, for only the indication of the strip of least period is considered.

In practice it is found that a dozen strips give sufficiently accurate determinations for most purposes; but the number of strips, the upper and lower limits of their rates, and the interval between successive strips, may of course, be varied *ad lib.* to suit the purpose in hand. For rapid commercial application it is found advantageous not to mark the strips in terms of their vibration rates, but to calibrate these rates with the tensions to which they correspond in wires of a given section, so that the readings may be made in terms of these direct. An even more utilitarian development is that which marks at the base of each strip the numbers of the guys in a plane of given type which should vibrate in unison with it; and the worker, knowing that harmony with a shorter strip indicates an excess of tension and with a longer one a lack, can then easily adjust each wire to the proper degree of rigidity.

Increasing the Potash Yield of Cement

THROUGH the use of common salt of a coarse grade it is possible to increase the amount of potash extracted from cement rock, thus securing a saving of potash that was hitherto going to waste. As a result of the use of this common salt one works has increased its output of potash dust by approximately 25 tons per day. of this quantity 10 per cent is said to be pure potash. The salt is mixed with the cement stone and other raw product used in the manufacture of lime, and these are then ground up in a mixer and burnt. The burning process eliminates the salt and potash in the rock.

The Electric Vehicle's Brilliant Future in England

IT is probable that after the war there will be a favorable opportunity in England for the sale of electrically-propelled vehicles. American manufacturers would do well to look to this field and be prepared when normal times return to get their share of the trade, we are told by Consul E. Haldemar Dennison at Birmingham. In the past this type of car failed to obtain much popularity, but the scarcity and high price of gasoline and the difficulty of obtaining any of the ordinary liquid fuels have caused a change.

Many persons are convinced that the price of gasoline will remain high even after hostilities cease, and in fact may never again be as low as in pre-war times. It is true that coal gas as a substitute for gasoline has been largely employed by many motorists, but for various reasons, especially on account of the space that it occupies only a small proportion have adopted it as a way out of the gasoline difficulty. Already the use of electric commercial cars has begun to show an increase, although they are difficult to obtain under present conditions.

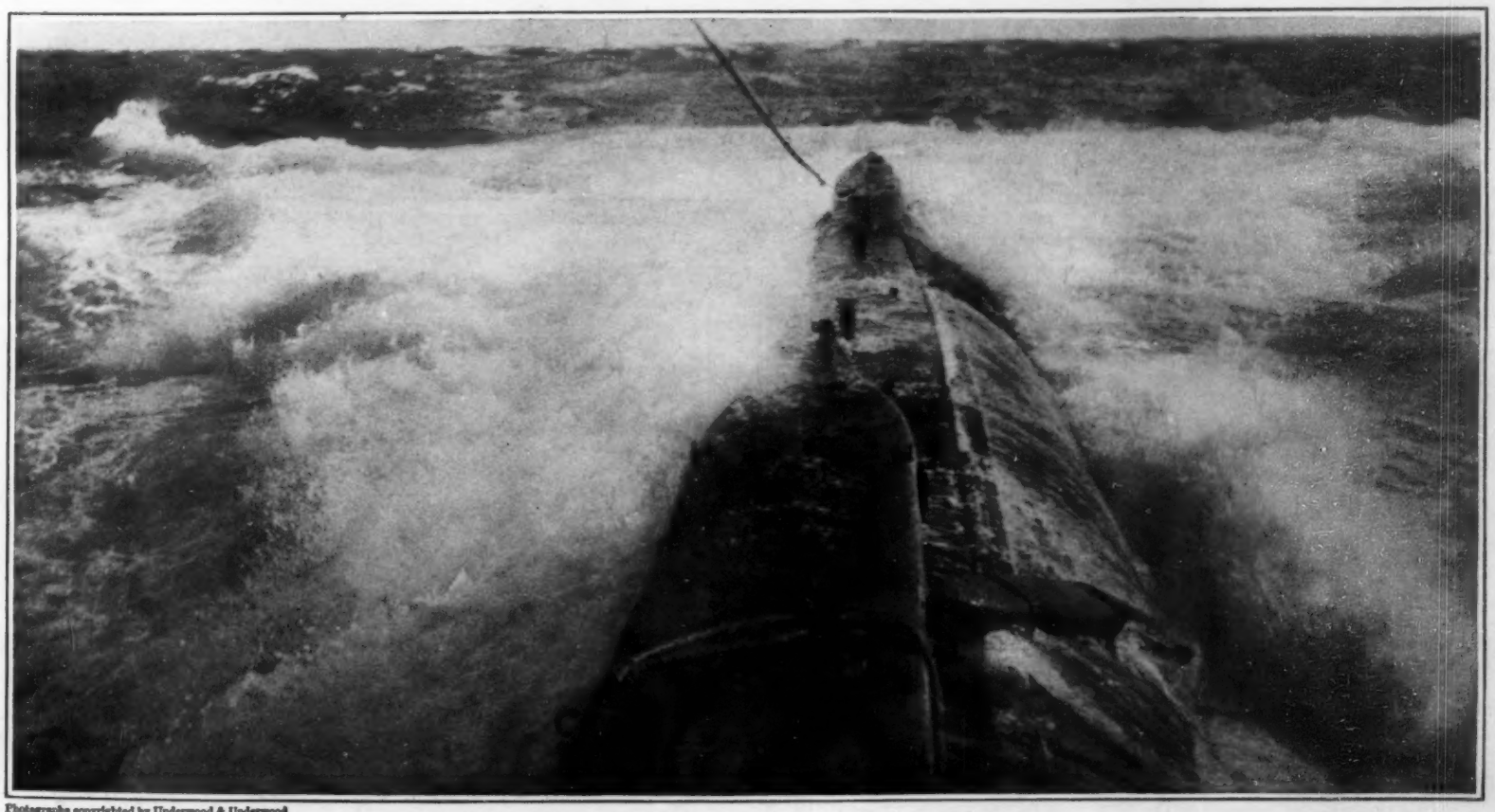
When the war is over it is thought that there will be a large demand for the electric car. Several municipalities have been experimenting with heavy electric vehicles and obtained satisfactory results. They have been found to be especially suitable for such work as town scavenging.

A heavy car which runs between the towns of Smethwick, Dudley, and Kidderminster in the Birmingham Consular District is supplied with electrical energy at a low cost. Birmingham is well situated from an electric-vehicle point of view. Not only is current cheap, but within a 50-mile radius of the city there are 22 charging stations, apart from the seven stations within the city.

Coal Economizer Frauds

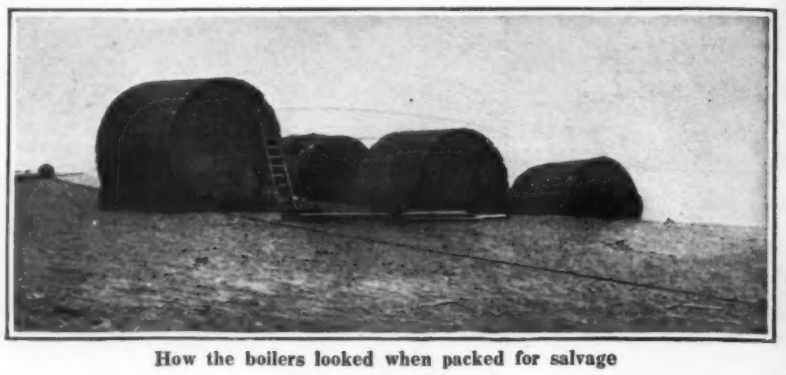
THE present shortage of coal in France has brought out numerous products of a fake description which, according to the accompanying notices, are intended to give a considerable economy of coal, either by putting on the fire or mixing up with the coal in small quantities. However, the Fraud Repression administration has been looking into the matter, and M. Filanceau reports that all these so-called economizers are intended to deceive the public. An idea of their makeup can be had from the following, with the economy claimed in each case: (1) Mixture of equal parts of carbonate and nitrate of soda, with 20 per cent oxide of iron. Saving is claimed to be 40 per cent of the coal consumed. (2) Chloride of sodium 70 per cent, carbonate of sodium 5 per cent, colcothar 20 per cent. Economy 50 per cent. (3) Impure carbonate of manganese; economy 40 per cent. (4) Carbonate of sodium 50 per cent, nitrate of sodium 20 per cent, also asbestos and graphite; economy 30 per cent.

All these products are accompanied by notices which give good advice as to best use of coal, such as lessening the draught, less coal on the grate, wetting the coal, etc., which is in itself valuable. As to the substances, while they may have some slight effect in increasing the combustion, this is not very strongly marked, especially with the small amounts which are used, and the other precautions will probably account for any seeming economy. M. Filanceau made an interesting experiment, for having obtained nine or ten per cent with one of the "economizers," he then obtained 13.5 per cent by the simple use of warm water, and states that the above substances give an economy only by the use of water which is required to mix them up before applying on the fire.



British submarine driving at the surface, through a rough sea

The "Bear" as she lay stranded on the beach



How the boilers looked when packed for salvage

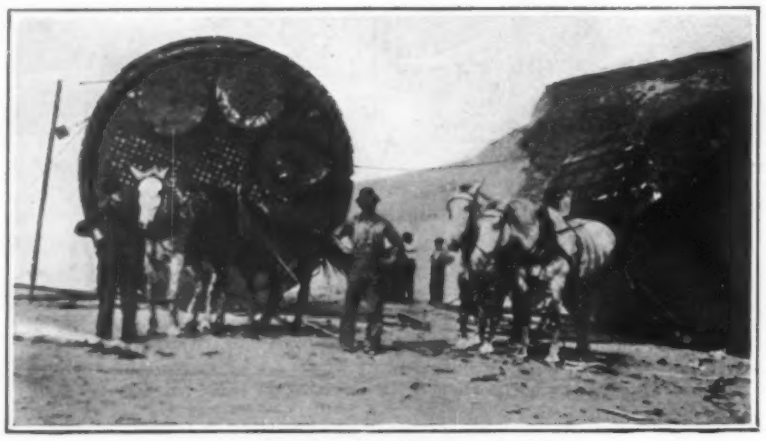
Salving the Boilers Out of a Stranded Ship

MANY and ingenious are the tricks by means of which the wreckers have contrived to save ships apparently doomed to be racked to pieces on exposed weather-beaten shores; but sometimes the conditions are such that no human ingenuity can extricate a vessel from the place where a storm has put her. In such event, all that the wreckers can do is strip her of everything of value which can be moved, and allow the empty shell of her hull to break up. And sometimes even in this they encounter difficulties which might well discourage less persistent folk.

Thus the steamship "Bear" recently went aground on the California coast near Eureka, being stranded in such a way that salvage was obviously out of the question. After all the small stuff had been taken out of her, the wrecking company decided to save her huge boilers, worth some $5,000 apiece. These great cylinders measured 13 feet 6 inches in diameter by 11 feet 6 inches in length, and weighed 51 tons each; and there were six of them. Now if a big boiler would float, it would be comparatively simple to drag it across the sand and heave it overboard, and then tow it to a place of safety. But a big boiler will not float in water, and it will hardly "float" on sand, so this line of attack seemed out of the question.

The engineers in charge, however, decided that rather than haul the boilers a long distance up the beach, and then meet the problems of shipping them overland, they would have to fix them up so that they would float. Accordingly they went to work on them, plugging up each individual water tube so that it was water-tight. A piece of iron pipe will not float, to be sure; but if its walls are fairly thin, and we seal it up so that it can contain nothing but air, it will float; and so, under the same conditions, will the huge package of thin metal pipes which constitutes the modern boiler. And by this method the boilers were saved, without mishap.

After each one had been completely plugged, it was lifted out of the ship's hold by a specially constructed derrick, placed in a big wooden cradle shaped like a barrel—or like a boiler, for that matter—and dropped overboard upon the sand. Teams of horses were then hitched to it, and it was hauled a long distance along the beach to a spot suitable for "launching." After that it was a simple matter to tow the boilers to Eureka, the nearest port, whence they are being shipped to Shanghai to be installed in another hull.



Hauling the boilers along the beach

Additional Secrets of the Super-Zeppelins

WITH the dismantling of the Zeppelin L-49 which was forced to land at Bourbonne-les-Bains and captured practically intact by the French on that eventful day when five or more German air raiders came to grief, further details concerning the construction and equipment are now available. A general description of the L-49 appeared in these columns several weeks ago.

It is understood that the present intention of the French authorities is to exhibit the more interesting parts of the L-49 at the Invalides in Paris, where so many war relics and trophies have been exhibited since August, 1914. Later the reconstruction of the gigantic German dirigible will be attempted; this task, it is now believed, will require several months of painstaking effort. At any rate, the dismantling operations have brought to light many details which were overlooked in the preliminary inspections of the craft, just after it had landed on a hillside.

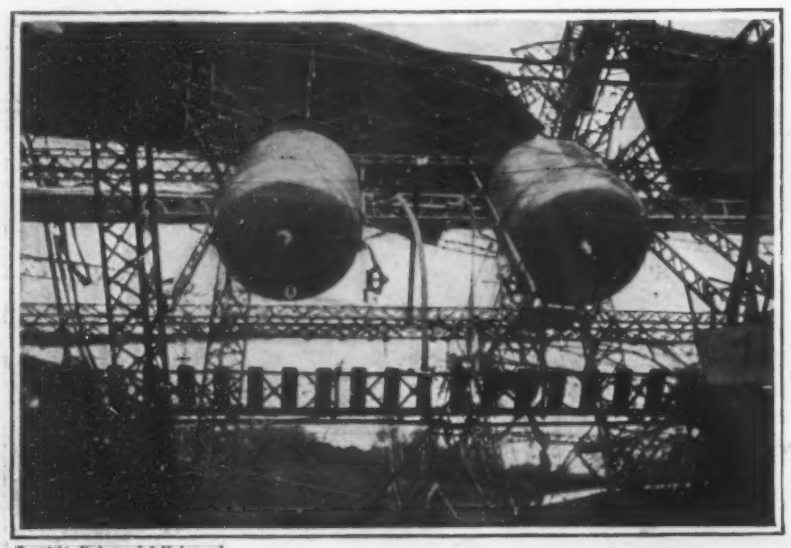
The framework of the present super-Zeppelin contains three distinct varieties of aluminum, namely, pure aluminum, aluminum alloyed with zinc, and duralumin. The last-mentioned variety is a well-known alloy of copper, manganese, and about 93 per cent aluminum; and although its weight is about equal to that of pure aluminum, it has three times the tensile strength. The framework of the L-49 has been estimated at 600 feet in length, 75 feet extreme diameter, and with a capacity of 55,000 cubic meters.

Along the bottom of the huge bag runs a triangular-shaped passageway walled in by a light metal framework, with its apex at the top. The gas bags fold over the triangular framework of this passageway, so that anyone passing through it is virtually surrounded by the gas bags on two sides and the aluminum framework and outer covering, surmounted by the footway, underneath. This gangway or "cat-walk" forms the keel of the big cigar-shaped bag, and serves to connect the various power plants and gun platform of the Zeppelin, with the forward or commander's quarters. The passageway is usually quite dark; but the footway is provided with a hand rail, while at intervals along the framework members small disks of radium paint serve clearly to mark the way. Indeed, control dials and sign boards in the main passageway and the branch passageways are provided with radium dials and characters, making the use of dangerous lights unnecessary.

(Concluded on page 486)

Front end of the commander's quarters of the Zeppelin L-49, showing the various controls

One of the "power eggs" or nacelles ready for transportation



Maze of aluminum comprising the framework of the airship, showing the "cat-walk" and two fuel tanks

Cylindrical aluminum fuel tanks of the Zeppelin, each capable of holding 300 liters of gasoline

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

The New Commissioner of Patents

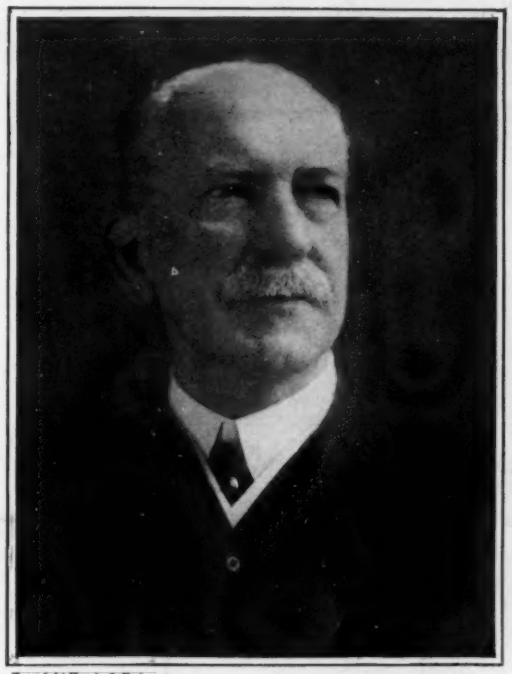
JAMES T. NEWTON, who succeeded Thomas Ewing as Commissioner of Patents on August 27th, 1917, has grown up in the Patent Office. Probably none of his predecessors took up the duties of the Commissionership with the thorough and unusual preparation which he brings to the office. He has served in the clerical force, having for some time been chief clerk of the Office. He has been principal examiner of a complicated and troublesome mechanical class as well as of Trade Marks and Designs. In addition he has been Law Clerk, member of the Board of Examiners in Chief, Second and First Assistant Commissioner; so that in this way he has occupied practically every office in the patent administration, and in every one has manifested his extreme usefulness.

The new Commissioner was born in Morgan County, Georgia, on July 17th, 1861, and educated there, graduating as Bachelor of Science from the University of Georgia at the age of nineteen. After five years of school teaching in his native state he came to Washington, first as a clerk in the War Department, later entering the Patent Office as a fourth assistant examiner on March 10th, 1891. While still a third assistant examiner he was selected as Law Clerk, May 8th 1893, and the following year was made Chief Clerk of the Patent Office. On April 1st, 1895, he was appointed Principal Examiner in Division 23, which at that time had also trademarks; and in the following year he compiled and published a digest of trade-mark decisions.

When Mr. Ewing came into office Mr. Newton was made Assistant Commissioner (November 14th, 1913), and in the following year, at the death of Mr. Frazier, he became First Assistant Commissioner. At his request he was put on the Board of Examiners of Chief on July 1st, 1916; but the retirement of Mr. Ewing again called him to the more strenuous executive duties as the head of the office.

With his thorough training, and possessed as he is of rare executive ability, as well as unusual popularity and sympathy with the examining corps, there is no risk in predicting for him a very successful tenure of the Commissionership. For his has been not only a very comprehensive service but a continuous service also; and while it is possible some previous Commissioner has prior to occupying that office been a member of the Board of Examiners-in-Chief, Assistant Commissioner or Principal Examiner, it is believed that no commissioner has heretofore occupied all of these positions in a continuous uninterrupted service, one not broken by a term on the outside in the practice of patent law.

Mr. Newton has always been a busy man, industry being one of his strong characteristics; and his ability thoroughly to understand a difficult complicated proposition is very unusual. He also has the rare judicial facility of hearing a case out before deciding; and his industry manifests itself not only in the actual efforts on his part but in his care, thoroughness and patience at hearings.



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James T. Newton, Commissioner of Patents

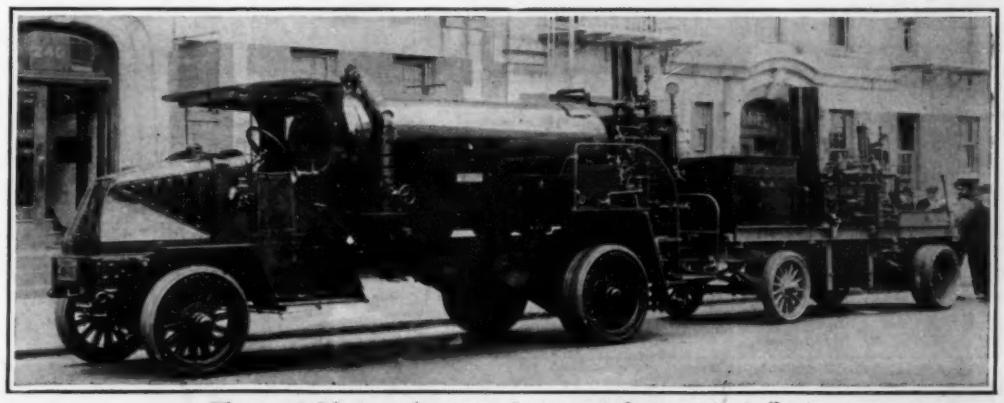
Tractor and Trailer for Road Work

AN interesting use of the trailer in connection with the motor truck indicates the widening field of usefulness for the special service vehicle that can be towed readily from one job to another. In this case the tractor and trailer are intended for modern road construction, the application of a hot bituminous binder to macadamized roads. The 5½-ton truck serves not only as a tractor for the heating device, but also as a distributor for the liquid over the newly surface droad. As the binder is also essential in constructing the best type of crushed rock foundation, the distributor is used at various stages in the building of new roads. With the general principles of this apparatus, the road engineers are familiar. The material is carried in a cylindrical tank and kept at the proper temperature by means of steam coils inside the tank. Steam is supplied by a boiler at the rear of the truck which burns fuel oil. The binder is discharged with force by means of a pump through the nozzles set close to the ground back of the rear wheels. At the conclusion of the operation, the steam is utilized to blow out the holes in the distributing manifolds, which would otherwise be clogged when the material cooled.

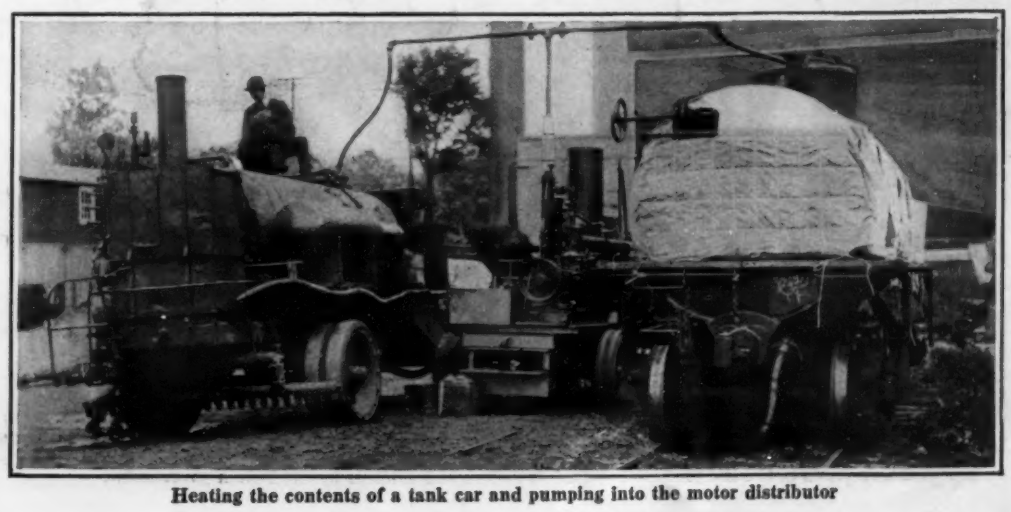
More novel is the use of a trailer in connection with this apparatus, which carries the necessary appliances to heat the fuel in railroad tank cars, and to pump it into the container of the distributor.

This trailer is taken to the railroad siding by the truck to serve there as long as needed. As it is not in constant use as a vehicle, but is rather a small, portable plant, there is no need of equipping it with a system for self-propulsion, and the tractor-and-trailer principle is therefore most economical. A four-wheel truck chassis is employed for this purpose, with standard truck front and rear axles. The flexibility of this outfit is shown by the fact that tractor and trailer together can make a complete turn within a 50-foot circle.

After being towed to the railroad siding nearest the construction work, the trailer serves as a steam plant, the tank car contents are heated by coils set within the tank, and to prevent radiation of heat a sheath of insulating material is fastened around the walls of the tank. When the bituminous material is sufficiently liquefied by heat, it is pumped into the tank of the motor truck as needed. The latter carries it to the road work, and keeps it at the proper temperature during distribution.



The unusual feature of a steam plant mounted on a motor trailer



Heating the contents of a tank car and pumping into the motor distributor

A New Electric Heating Unit That Looks Like a Two-Foot Rule

TO light up a remote dark corner, or a detached building, it is a simple matter to extend an electric lighting circuit and add another lamp or group of lamps according to the conditions and amount of light desired.

This same feature of flexibility and ease of extension can be taken advantage of, in the way of heating such places as crane cabs, pump and valve houses, signal and watch houses, turntable cabs, theater ticket booths, and various other locations where because of exposure or physical conditions, heat (or additional heat) is required. This has been made possible through the development of a rugged electric heater unit that looks like a two-foot ruler. These units are simply connected to a lighting or power circuit like so many lamps and may be distributed (like lamps) where they will do the most good. The entire nickel-chromium resister or heating element is buried in an enclosure of mica, around which a steel jacket is placed and sealed under an hydraulic pressure of about twenty tons. Two insulated eyelet holes are provided for mounting and two connector posts serve for making the connections to the circuit.

Traffic officers, crane operators and signal men have employed this type of electric unit for keeping their feet warm. It is possible to keep other parts of the body warm with heavy clothing but the feet usually suffer. When units are used as above a heavy perforated metal plate is supported about two inches above the floor, with a unit or several units placed between, allowing an air space between the units as well as between the units and the surface above and below to permit circulation. A current of warm air then passes up through the perforations. The units, being only $\frac{3}{16}$-inch thick and 1½ inches wide, can be used in a very small space.

Incandescent Lamp with Renewable Filament

A REFILLABLE incandescent lamp is a recent new departure. In this lamp, which is of the gas-filled type, there is no need for a vacuum, as it is only necessary to retain the gas in the globe under its own pressure. Accordingly the lamp is so made that the globe can be removed to permit the renewal of the filament, and when the globe is attached to the head the joint is tight enough to retain the gas admitted. Further, in the head is provided an easy means for refilling the lamp with gas.

Upon the filament being rendered useless the globe can readily be unscrewed from the head and the filament withdrawn through the neck of the globe. After a new filament has been substituted the globe can be replaced. At this time, however, it is necessary to recharge the globe with gas. This is done by removing a screw plug and utilizing the hole thus made. Upon the globe being filled with gas it is screwed tightly in and the plug is inserted

Inventions Which Meet the Needs of Modern Warfare

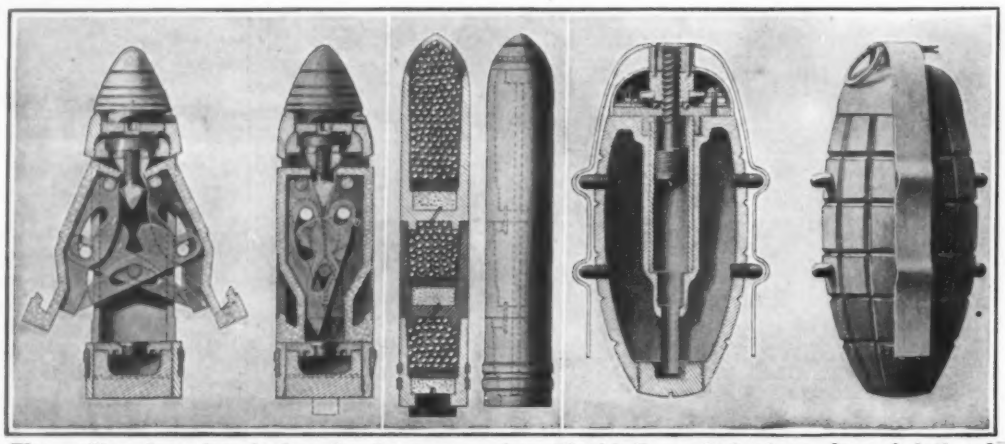
BECAUSE of the extensive employment of machinery in the world war, the inventor has the opportunity as never before to serve his country in his own favorite way. For the struggle in which we are now engaged has long been recognized as a contest between the great minds of the Central Powers and the Allied Powers—between inventors of both camps.

Typical of the inventions which the war has developed are those shown in the illustrations herewith. The first example is a shell for cutting barbed-wire entanglements, which is designed to travel through the air with the ease of the ordinary shrapnel or high explosive shell until it reaches the target. Most wire-cutting shells have never proved practical for the reason that their wire-cutting members are actuated when the shell leaves the cannon, with the result that the added wind resistance of these members greatly limits the range and interferes materially with the accuracy of the projectile. In the present case the two hook-shaped wire-cutting members are hinged as shown, and normally fit into slots in the shell case, where they are held by a soft metal band. The time fuse in the nose of the shell is set for any given distance, and serves to detonate a small charge just back of it. The explosive charge, in turn, pushes down a cone-shaped plunger which spreads out the wire-cutting arms. The cutting members are held in place by other members as indicated.

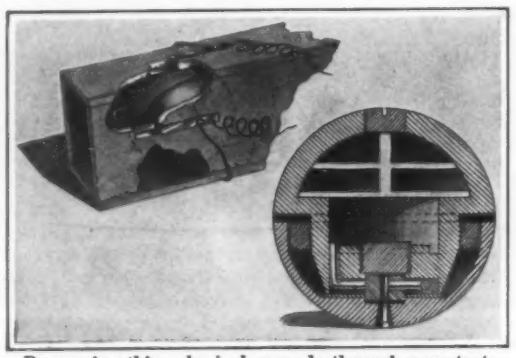
In order to make shrapnel more effective, especially when used against hostile aircraft, Edward Dartford Holmes of Huddersfield, England, has invented the multiple-charge shrapnel shell shown in the second illustration. Briefly, his scheme calls for a shrapnel shell containing a number of compartments which are each exploded in turn at predetermined intervals. And in order that the gunners may follow the progress of the explosion, each chamber is filled with a charge which will emit a different colored smoke. Two types are shown, one with the time fuse in the base, arranged to explode base-charge first and nose-charge last, and the other where the fuse is in the nose and connects with the separate charges by means of a long tube filled with a priming composition.

Numerous schemes have been suggested for making hand grenades safe for everyone except the enemy. A typical case is presented in the third illustration, which shows a hand grenade equipped with the usual safety pin and, in addition, safety arms. When the grenadier is ready to use the grenade, he removes the safety pin at the top. However, in this particular hand grenade the firing pin is screwed into the member which holds the safety arms in place, and it cannot disengage itself except by the rotation of the arms. In practice it appears that when the grenade is hurled, the safety arms rotate a few times and so release the firing pin, making the missile "alive." The safety arms, of course, drop to the ground. Should the grenade be dropped accidentally, or should it strike near friendly positions, the arms do not have sufficient time to rotate and release the firing pin, hence the grenade does not detonate.

For a similar purpose but employing electricity instead, the last illustration represents the scheme of Maurice Velin of Rambervillers, France, for making hand grenades safe until hurled at the enemy. In brief, the grenade in this case is round and consists of two metallic parts insulated one from the other and electrically connected by a fusible member, embedded in black powder. The black powder charge, in turn, connects with the explosive charge by a time fuse which may be regulated to suit conditions. As the grenades are required they are passed through a square wooden tube every side of which carries a contact spring that projects into the passageway. The contacts being connected to opposite poles of a battery, it follows that no matter how the spherical grenade passes through the wooden tube the circuit between any two contacts is closed and current passes through the fuse.



These military inventions, in the order shown, are a wire-cutting shell, a multiple-charge shrapnel shell, and a hand grenade which is made "alive" by the revolving of its safety arms



By passing this spherical grenade through a contact-making tube, it is made ready for use

Life Preservers Which Inflate Only When Needed

AS an answer to the submarine warfare ruthlessly waged by the Germans against Allied and neutral shipping, Italy has developed a most ingenious type of life preserver which is issued to sailors and soldiers passing through the danger zone. Inexpensive, light in weight and compact, the present life preserver can be worn with no more discomfort than the usual gentleman's vest; yet the moment the wearer is obliged to take to the water, a slight pull on two tasseled strings causes the heretofore flat belt to inflate until its gas cells are capable of supporting 250 pounds of dead weight.

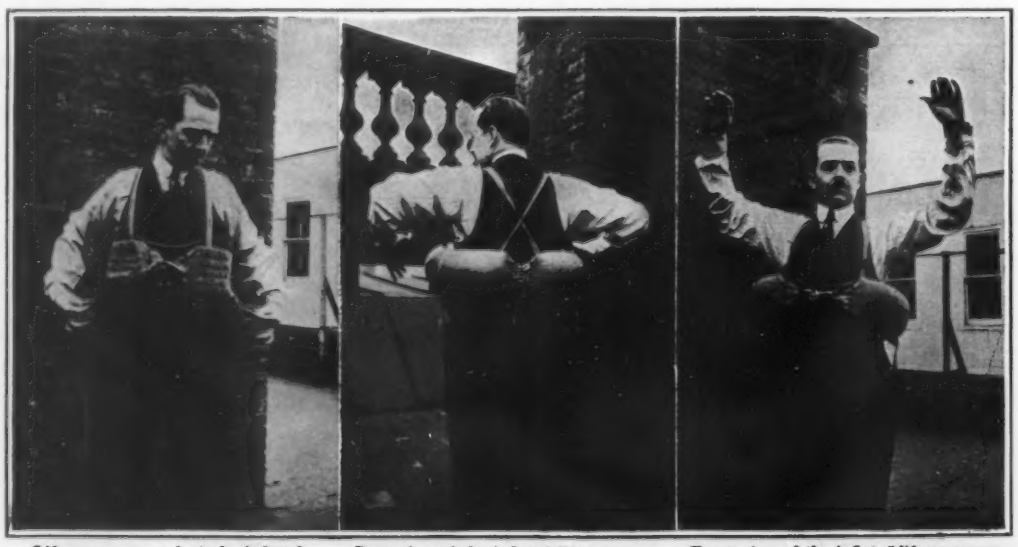
The present life preserver consists of two sections held together by straps and strings so as to form the complete belt. Ordinarily, it is perfectly flat and can be worn under a coat without inconvenience. Each section comprises a pair of rubber bags connected together by a small passageway; and the passageway, in turn, is controlled by a simple valve. Each rubber bag has its individual filler stem which, by means of a screw cap, can be hermetically sealed.

Automatic and manually-operated life-preservers, in normal and inflated states respectively

To charge the life preserver one rubber bag of each section is filled with a certain quantity of water in which a small quantity of sodium carbonate has been dissolved, while the other bag of each section is filled with water containing a little tartaric acid. To facilitate the charging operations, the life preserver is supplied with packets containing the right quantity of each ingredient. Once charged, the belt is ready for instant use.

The action is as simple as it is positive: When the tasseled strings are pulled, the valve between each pair of rubber bags is opened, allowing the charges to come together. Chemical action takes place, and one of the products is a large volume of gas which fills the bags until they are fully distended. Only a few seconds are required to generate the gas and prepare the life perserver for use.

Differing only in the matter of valves, a second type of life preserver is also issued by the Italian authorities. This consists of a life preserver in which the manually-operated valves are replaced by automatic valves, and instead of depending upon a slight pull on tasseled strings, the sea water coming in contact with soluble pellets or cartridges dissolves them and opens the valves. In every other particular the second type is the same as the first.



Life preserver ready to be inflated — Rear view of the inflated life preserver — Front view of the inflated life preserver

Three views of the life preserver issued to sailors and soldiers by the Italian government

A Fire-proof Solution for Treating Airplane Fabrics

JUDGING from the results obtained in tests of airplane fabrics treated with a new fire-proofing solution, it would seem that the fire-proof aircraft is a thing which can be realized in the immediate future. And since fire is one of the greatest dangers an airman has to contend with in aerial warfare, this should be a big step forward in the art.

The present fire-proofing solution is the product of a concern situated at Ithaca, N. Y., and for some time past numerous samples of linen have been treated and submitted to the proper authorities for exhaustive tests. It is said that linen thus treated provides a linen base which has the same tensile strength and shrinking qualities as the original material. So thoroughly is the linen fire-proofed that a white-hot coal will only char the size of the coal when placed on the stretched airplane covering. A current of wind or a blast of air will not make the flame run or the linen burn. Flaming will not take place and charing will not extend beyond the point of direct contact with fire or intense heat. Gasoline poured on both sides will burn off without injuring the linen.

The treatment of airplane fabrics consists in passing them through a series of chemical baths, which, having a chemical affinity for the fibers, penetrate every particle of the fiber. It is claimed that the fibers are in this manner preserved because they are made proof against moisture which is usually the cause of decay and loss of strength. At the same time the fiber is made fire-proof.

Aside from airplane fabrics, tests have been made with samples of canvas in various weights, and khaki, by the Aeronautical Division of the United States Signal Corps. Each treated sample was found satisfactory as to fire-proofing, and the shrinking qualities and strength of the fabric were in no wise affected.

Yarns which have been treated through the new process are now being tested by a large electrical manufacturer to ascertain the comparative moisture absorption, water resistance, electrical conductivity and resistance, with a view to their use as insulation on cotton-covered conductors and cords.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of SCIENTIFIC AMERICAN.

Pertaining to Apparel

GARMENT.—MARJORIE A WICKES, 220 W. 98th St., New York, N. Y. The object of the invention is to provide a garment more especially designed for use on babies and arranged to permit convenient enlargement of the top, front and back of the shoulder portions of the garment to readily compensate for the growing of the infant. To accomplish this result use is made of folds extending transversely across the top of the shoulders, the folds being held in position by temporary fastenings which allow of opening as the infant grows.

METALLIC HEEL.—H. VARWIG, care of Frank Caldwell, 7510 Cornelia Ave., Carthage, Ohio. One of the principal objects of the invention is to provide a metallic heel so constructed that it will carry a replaceable leather facing or tip, which may be readily and expeditiously removed. Another object is the provision of means for securing the plug or tip to which the facing is secured in place within the heel.

Electrical Devices

SHORT-CIRCUITING DEVICE FOR MOTORS.—M. I. GINSBURG, 109 N. 6th St., Philadelphia, Pa. The general object of the invention is to simplify the construction and operation of apparatus of this character. A more specific object is the provision of an improved short-circuiting device which automatically comes into play when the armature attains a predetermined rotative speed, whereby the windings of the armature are short circuited.

AUTOMATIC SWITCH FOR TELEGRAPH-RECEIVING SYSTEMS. C. B. COOK, Foreman, Ark. The purpose of the invention is to provide a simple device which will automatically connect a sounder first with one line and then with another in succession, so that the operator does not have to make the connection himself; where a telegraph operator has to attend to other duties it will be seen that this device saves considerable time.

Of Interest to Farmers

MOWING BLADE.—E. B. FUQUA, R. F. D., No. 6, Memphis, Tenn. The object of the invention is to provide a device, wherein the cutter is an endless belt carrying cutting blades which cooperate with fixed blades or guards, the cutter carrying belt being mounted in a hollow sickle bar with blades extending from one edge thereof thus eliminating the shock and jar of a reciprocating blade and consequent loss of power.

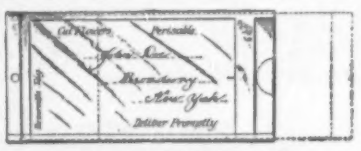
TRACTOR.—H. C. HARTLINE, Cobden, Ill. The object of this invention is to provide a tractor designed for hauling threshing machines, wagons, and other vehicles, or for drawing plows and other farm machinery over the fields, it is arranged to permit of conveniently and quickly steering the tractor or turning it around in a comparatively small space.

TRACTOR.—P. A. JOHNSON, Stoughton, Wis. This invention relates to tractors particularly arranged for use on farms, it has for an object the provision of a structure which may be quickly and easily turned and which will travel in a certain direction without danger of side movement. Another object is to provide a tractor in which the motor or other driving mechanism are arranged at the front, the structure being such that the entire driving mechanism may be rotated without affecting the position of the frame of the tractor.

Of General Interest

SAFETY PIN.—J. H. FOWLER, Box 189, Yeagerton, Pa. The object of the invention is to provide a safety pin having generally a greater capacity for connecting articles of clothing and the like, than is provided by the ordinary safety pin. This pin comprises a pair of spaced parallel prongs and a head disposed at right angles to the prongs at the rear end, the head being in the form of a laterally elongated loop having rear inwardly projecting extensions and having a forward cross bar overlying the prongs adjacent to the rear ends, and a keeper having means to frictionally engage the free ends of the prongs.

REVERSIBLE TAG.—A. J. LOVELESS, Wyndhurst Gardens, Lenox, Mass. The invention has for its object to provide a reversible tag having a body which may be stamped out of sheet metal and may be quickly bent into shape, the body



A PLAN VIEW OF THE TAG

having a guideway in which a card may be slipped to exhibit either side as desired. The bent over sides form a guideway for the card, an orifice at the end of the tag serves to hold the card in place when a cord is passed through the tag and tied.

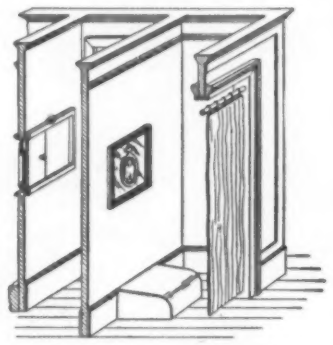
MAYONNAISE MIXER.—W. J. DRUCKER, 387 Ocean Ave., Woodhaven, L. I., N. Y. The object of the invention is to provide an inexpensive and efficient device particularly adaptable for the mixing of mayonnaise, it is characterized by a revoluble container and a stationary member constituting the agitator of the mixer, the device is simple and may be easily maintained in sanitary condition.

SHADE HOLDER.—R. S. BLYTHING, Walton, N. Y. The invention has for its object to provide a shade holder which is cheap in construction and which may be conveniently adjusted to fit any window or door. In connection with the shade holder, curtain brackets are provided which may be readily mounted on the shade holder. For adjusting the holder, two fasteners are provided each having a slot in which a slide is disposed, set screws being provided by which means the slides may be held in position.

CORN PAD.—ANNE BOONE, 696 Richmond Turnpike, Staten Island, N. Y. The invention relates to a pad which is adapted to be applied around a corn on the foot or other part of the body, whereby the pressure of the shoe or other covering will be removed, the pad is designed by coiling yarn into a plurality of layers according to the thickness desired, it can be washed and kept in a sanitary condition without losing its cushioning property, and may be bound in place by the use of adhesive strips.

HAND BAG.—A. KULICK, care of Elk Leather Goods Co., Inc., 130 W. 29th Street, New York, N. Y. The object of the invention is to provide a hand bag arranged to allow of holding the mouth of the bag in open position for the insertion or removal of articles, and to permit of conveniently opening and closing the bag without danger of the draw strings becoming entangled or tearing the material at the mouth of the bag body.

SANITARY CONFESSIONAL WINDOW.—L. C. KNISSEL and W. J. MCCLENAHAN, address Walter J. MCCLENAHAN, 867 Fresh Pond Road, Ridgewood, L. I., N. Y. Among the objects of this invention is to provide a partition window through which conversational intercourse may be



SANITARY CONFESSIONAL WINDOW

readily carried on, and which is of such a nature that there shall be no material obstruction as to sound waves but which shall serve as a means for effectively preventing the transmission of the breath or other germ laden mediums between the individuals on either side of the partition.

PROCESS OF PREPARING A NON-ALCOHOLIC CHILL-PROOF BEVERAGE.—J. BEERHALTER, care of Fitger Brewing Co., Duluth, Minn. An object of the invention is to prevent normally soluble proteids of the non-alcoholic beverages from becoming insoluble due to a change of temperature or laps of time. Another object is to produce non-alcoholic beverages rich in proteids, which possess great stability and which do not become turbid or cloudy even when chilled for a considerable period of time. The inventor claims to obtain the results by employing proteolytic enzyms in the finishing of the product

TOBACCO PIPE.—R. W. GRAVES, 900 E. Jersey St., Elizabeth, N. J. The object of the invention is to provide a tobacco pipe arranged to permit the user to readily keep the stem clean and sweet by the use of an absorbent material contained in the pipe stem, and to permit of conveniently removing the saturated absorbent material from the pipe stem without danger of the smoker soiling the fingers. A further object is to prevent the nicotine from passing to the mouth of the smoker.

PRINTING MACHINERY.—A. B. EVANS, Leeds, England. The object of the invention is to provide devices by which wastage of paper particularly in machines of the lithographic type, can be avoided, means are provided for removing the nip of the nipping or leading rollers from the web, as and when required, without interrupting the continuous revolution of the machine.

PROCESS OF PRODUCING SYNTHETIC ASPHALT LIMESTONE.—C. L. V. ZIMMER, Berlin-Wilmersdorf, Germany. The object of the invention is to provide a process for producing synthetic asphaltic limestone, which, when heated also decomposes to a powder, which like the natural product, can be compressed into a solid condition and yields a road equal to those from the natural asphaltic limestone.

CLOTHES LINE PROP ATTACHMENT.—H. E. RICE, Box 10, Cameron, Miss. This attachment is manufactured of a piece of resilient wire the central portion of which is looped and is held yieldingly in operative position by coiled portions of the wire beyond which the terminals of the wire extend for disposal against the prop the terminals being bent to form seats in which the clothes line is held by the looped portion of the wire when in operative position.

DISPLAY DEVICE.—J. T. BERTHELOTE, 408 10th St., Harvre, Montana. The device relates to a means to display notices such as are usually posted up in court houses and other public buildings, the general object is to provide a cabinet for the effective display of notices such as referred to in an orderly and conspicuous manner and quite safe from mutilation or disturbance.

METHOD FOR BUILDING CEMENTITIOUS PARTITIONS AND SUPPORTS THEREFOR.—E. FLAGG, 109 Broad St., New York, N. Y. An object of the invention is to provide a simple method of building partitions of cementitious material. A further object is to provide a flexible support for the partition which is adapted to be drawn taut under the weight of the plastic mass applied, to allow the anchoring of said partition in tautened position. The support is a fabric made of expanding metal, secured by hooks to a rod supported from hangers secured to the ceiling; the lower edge of the fabric may be secured to the floor.

CLUSTER TOP.—A. L ELIASOFF and C. BIRNBAUM, 871 E. 170th St., New York, N. Y. Among the principal objects which the invention has in view, are to furnish a metallic light reflecting member for simulating the under body of a gem, in a finger ring or pin, to reinforce settings for massed small stone clusters, and to provide a reinforcing member having centrally disposed light-refracting surfaces for simulating the refracted rays peculiar to certain gems.

WALKING STICK.—E. SCHLICK, 16 Rue de Toul, Nancy, France. The invention relates to a walking stick useful as an aid to a wounded or invalid person, and affording relief to the wrist by transferring a part of the weight of the body to the forearm. The walking stick is provided at the upper end with an oblique support, fixed or with compensatory movement, on which the forearm rests, being held on the said support by engaging in a holding arrangement of semi-circular form.

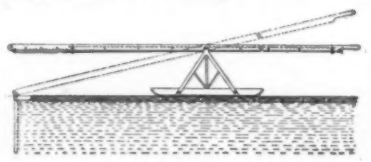
LOOSE-LEAF BOOK OR BINDER.—J. W. MYATT, 37 Victoria Rd. Tipton, England. The object of the invention is to provide a simple and inexpensive loose-leaf binder, applicable to note books, loose catalogue sheets and the like. The device is provided with leaves having notched rear edges, covers, and elastic band permanently attached to the covers, a pair of connecting pieces between the covers for engagement by the notches of the leaves, the band embracing the opposite edges of the covers.

PENCIL ATTACHMENT.—R. GOSMAN, Amagansett, L. I., N. Y. An object of this invention is to provide a holder for both a pencil, or pen, and a quantity of paste, the holder being provided with a slidable plug or follower between the paste and the pencil chamber, the follower being adapted to be pushed by the unsharpened end of the pencil for the purpose of ejecting the paste from the opposite end of the holder.

PROTECTOR.—A. R. HOUSE, Pearson, Ga. The invention has for its object to provide a device for the use of barbers, dentists and doctors, for protecring them against discomfort and contagion when at work. It comprises a semi-rigid shield shaped to fit over the nose, and having a cushioning facing at its edge for engaging the face, it is provided with respiration tubes at each side which act as supports for holding the protector close to the face.

BOTTLE CAP.—A. L. BERNARDIN, Evansville, Ind. This inventor has been granted two patents on bottle caps, the first relates more particularly to caps for catsup bottles, the object being to provide a cap capable for sealing a bottle in the first instance, and of use as the ordinary screw-cap during the gradual use of the contents of the bottle, after breaking the seal, the second relates to catsup screw caps of the pierced type prior to the production of which catsup screw caps of the length required were of the seamless or drawn type, the manufacture of which so strains the metal as to make it impossible to apply laquer or other coating in the sheet.

LIFE-SAVING DEVICE.—G. J. HANLON, Lincoln Ave., Rosedale, L. I., N. Y. An object of the invention is to provide a simple, inexpensive and efficient device whereby a person who has broken through the ice can be saved without endangering the life of the rescuers. The device



LIFE-SAVING DEVICE

comprises, a running plank, a carrier detachably supporting the running plank, a grab hook and means for detachably securing it to the running plank, a drop ladder, and sliding means operable from the end of the plank for retaining the ladder at the plank and releasing it to hang substantially.

SMOKERS' POUCH.—H. H. SCOTT, address D. E. VICTOR, Field Service Shoe Co., 505 5th Ave., New York, N. Y. This invention relates to a pouch for tobacco and accessories such as smokers use, either in conjunction with a pipe or for the making of cigarettes, it embodies in the main a recepticle for the tobacco to which free access may be had when the closing cap is swung open. In conjunction with the closing cap there are provisions for the carrying of matches and cigarette papers. The essential object is to provide a device of compact form.

IRONING BOARD.—S. L. HAMPTON, 419 S. 8th St., Burlington, Iowa. The invention has for its object to provide a device of the character specified to be used with ordinary kitchen tables and the like, which when not in use may be pushed beneath the table cover out of the way, the table is provided just beneath the tops with a slot in which the ironing board is mounted to slide.

PROCESS FOR THE MANUFACTURE OF CEMENT, ETC.—L. P. BASSET, 52 Rue Taitbout, Paris, France. The invention relates to a process of manufacture of cement or hydraulic lime with the simultaneous production of sulfurous anhydrid or of sulfur, based on the decomposition of sulfate of calcium by charcoal or an equivalent reducer and clay. This process is characterized, by the fact that the complete decomposition of the sulfate of calcium is obtained by means of an excess of sulfid of calcium, and the excess of sulfid is then reduced by oxidation.

LINTEL.—F. HEATH, National Realty Bldg., Tacoma, Wash. An object of the invention is to provide a lintel construction, built of hollow blocks, in which lintels of various withs may be made, the hollow blocks being the same as those which are used in building hollow walls. A further object is to provide a construction in which the blocks forming the lintel are not only joined together longitudinally by means of reinforcing rods, but locked together laterally by the same rods.

FRUIT HOLDER.—W. E. BROWN, 527 41st St., Sacramento, Calif. Among the principal objects of the invention are, to hold fruit without soiling the hands of the operator while extracting juices therefrom, to avoid the extraction of oils and unpalatable parts of the skin of citrus fruit when extracting the juices, to maintain the grip of the holder upon the fruit during the operation of extracting juices, and to simplify the construction of the holder.

TORPEDO GUARD.—H. J. DE ROSA, 3 James St., New York, N. Y. The invention has particular reference to protection of ships' hulls against danger from hostile torpedoes, submerged mines, cannon shots or other dangerous conditions. Among the objects is to provide a system of armor plates articulated together on either side of the hull and extending both above and below the water line and spaced laterally from the main hull structure.

PHOTOGRAPHIC CAMERAS.—H. W. HALES, Ridgewood, N. J. The object of this invention is not only to obtain extreme rigidity but also to produce a camera much lighter in weight, easier to load and of such construction that there are no detached parts to be lost or injured when in use, and to provide a more absolutely light-tight camera. Another object is to permit of folding the camera parts into a very compact form and yet hold the parts securely in place when extended for use.

CRUCIBLE USED FOR TYPOGRAPHIC PURPOSES.—C. WINKLER, Berne, Switzerland. The invention relates particularly to casting stereotype plates and type metal blocks. According to the invention a cock plug for regulating the outflow of the metal projects in the crucible itself to such an extent that the appendix, feeding head or riser formed in the outlet opening of the plug, by turning said plug is separated from the plates, and brought back immediately into the crucible.

Hardware and Tools

LOADING TOOL FOR TIME-TRAIN RINGS.—R. R. STABLER, 108 E. 20th St., Baltimore, Md. The invention relates generally to loading tools for the time rings of shrapnel shells, it is more particularly a combination of parts used for the purpose of holding the time train rings when filling their powder grooves, and when pressure is applied to thoroughly pack the powder in the grooves. The object is to materially reduce the number of parts now employed for this purpose, and in this way reduce to a minimum friction between parts and the danger of explosion.

RESILIENT TOOL REST.—L. J. PIANA ROSA, 461 Chestnut Ave., Trenton, N. J. An object of the invention is to provide a rest or holder for a tool which will allow the tool to move when an extra strain is brought to bear thereon and thereby prevent the tool from gouging or digging into the work. A further object is to provide a holding device which may be used for lathes or other machines, for holding a tool in proper position for cutting, while allowing the tool to move aside when undesirable pressure has been brought to bear upon it.

HOLLOW METAL JAMB AND TRIM.—D. PERIBONIS, 947 E. 156 St., New York, N. Y. An object of the invention is to provide a hollow metal jamb and trim which is secured by means of concealed fasteners no drilling or tapping to be done during the erection, and which does not utilise any screws for connecting the various parts constituting the jamb and trim. The fastening method has a plurality of elongated alining spaced slots, each terminating with an enlargement at one end through which the head of a bolt may be inserted.

WRENCH.—P. P. PEREZ and F. S. BATISTA, address F. S. Batista, P. O. Box 135 Key West, Fla. The objects of the invention are to provide an adjustable retaining means for the movable jaw of the wrench and to improve the manner of forming and yieldingly mounting the relatively fixed jaw. The wrench is adapted for general use and is particularly effective as a pipe wrench.

JACK OPERATING ATTACHMENT.—J. L. DOWNS, 1017 Nelson Ave., High Bridge, Bronx, N. Y. This invention relates to lifting jacks of that type in which the movable load carrying element is actuated by a rotary shaft operatively connected with the element, the invention deals particularly with an attachment for operating the shaft with less applied power and greater ease on the part of the operator and in a more comfortable position.

(*Concluded on page 484*)

RECENTLY PATENTED INVENTIONS

(Concluded from page 482)

MILLING CUTTER.—W. A. JAMES, 32 Summer St., Woonsocket, R. I. A specific object of this invention is to provide a tool made of relatively movable body sections having in the circumferences alining slots to receive the teeth, and also having interengaging means whereby relative rotation of the body section is produced when the sections are drawn axially together, so that a torsional effect is exerted on the inserted teeth to effectively grip the same.

SPRING HINGE.—O. KATZENBERGER, 228 W. Superior St., Chicago, Ill. The invention has for an object the provision of a light spring hinge construction in which friction is reduced to a minimum. Another object is to provide a hinge which has leaves pressed from single pieces of material and formed with ball races, whereby the weight on the hinge may be taken up by friction balls arranged in the ball races.

LAVATORY STRIKE.—O. KATZENBERGER, 228 W. Superior St., Chicago, Ill. An object of the invention is to provide a strike capable of a limited adjustment in order to be capable of application to slabs of marble or other supports of different sizes without changing the general appearance of the device. A still further object is to provide a strike in which the movable or adjustable member is so interlocked with the remaining parts as to be incapable of loss.

MARKET WEIGHING SCALES.—T. B. POWERS, 78 Warren St., New York, N. Y. Among the principal objects which this invention has in view are, to prevent the oscillation of the index members employed in scales of the character mentioned, to provide means for arresting the oscillation mentioned which does not interfere with the operation of the mechanism scales, to provide means for correcting the operative relation of the index mechanism and the mechanism of the scales, and to vary the time factor in the operation of the scales.

JACK.—P. E. VALENTINE, Ready, Ky. The invention has for its object to provide a jack especially adapted for use with a brass puller forming the subject matter of Patent No. 1,220,911 granted March 27, 1917, to the same patentee, wherein a base is provided for engaging beneath the tread of the rail and a plate connected therewith for engaging the flange of the rail, the jack being mounted upon the base to be moved toward and from the flange engaging the plate.

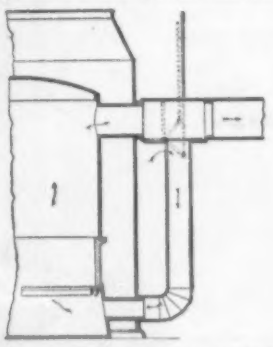
LOCK.—L. GOSHIE, 203 East 13th street, New York, N. Y. The object of this invention is to provide a construction which prevents a burglar or other unauthorized person from forcing the bolt back after it has once been projected into its keeper. Another object is the provision of a pivotally mounted attachment for the end of the bolt which will allow the bolt to freely reciprocate under ordinary circumstances, and allow the bolt to freely move back unto the lock casing when the door is closed, but will prevent any one from engaging the inclined surface of the bolt for forcing the bolt back into the casing.

FASTENING DEVICE.—G. H. GERAERDTS, 1445 Boone avenue, Bronx, N. Y. The invention relates to walls, partitions and similar structures made of composition sheets, such as plaster boards, and providing a seat for receiving and retaining a reinforcing bar to reinforce the partition. In accomplishing the desired result use is made of a fastening device formed from a blank of sheet metal and having spaced retaining saddles extending in opposite directions and straddling adjacent sheets with a view to hold their opposite edges spaced apart.

METAL BED OR CRIB CORNER.—H. S. WEISSMANN, address Chas. Goldenberg, 261 Broadway, New York, N. Y. Among the objects of the invention is to provide a corner piece, made of sheet metal and secured rigidly to one of the vertical corner posts. Another object is to improve the construction of a bedstead with respect to the means for securing the mattress supporting frame to the other main portions in such a manner as to not only support the frame but provide a positive interlocking engagement between all the parts of the structure.

Heating and Lighting

DRAFT REGULATOR.—W. J. MORELAND, Skaneateles, N. Y. This invention relates to stoves and furnaces and has particular reference to means applied to or used in connection with smoke



VERTICAL SECTIONAL VIEW OF FURNACE AND SMOKE FLUE WITH DEVICE

flues for controlling the draft through the fire box. Among the objects is to provide means for so regulating the draft as to cause the direction of the draft to be reversed through the fire box by the manipulation of a single member.

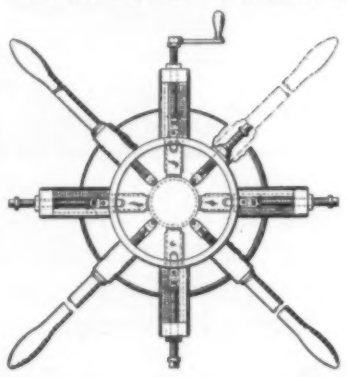
Machines and Mechanical Devices

TENSION EQUALIZER FOR PRINTING PRESS WEBS.—J. M. TRIER, 1022 Jackson Ave., Bronx, N. Y. Among the principal objects of the invention are, to maintain an even pressure on paper while being fed to a continuous acting printing press, to take up slack which may occur in paper when delivered to a press from rolls, to prevent tearing or breaking of paper while being delivered to the printing press, to maintain the speed, and smooth the web while being delivered to the press.

FRUIT AND VEGETABLE PEELING MACHINE.—J. H. HAMLIN, care of Bramhall Dean Co., 261 W. 36th St., New York, N. Y. The invention has particular reference to means for peeling potatoes or similar vegetables by an abrasive action, the machine is adapted for rapid operation and so designed as to treat large quantities of potatoes in a thorough manner and yet with the minimum amount of waste of the vegetables.

HYDRAULIC JACK.—R. W. GAFFNEY, 54 Victor St., Yonkers, N. Y. The object of the invention is to provide a hydraulic jack which may be readily carried about and placed in position for use on heavy trucks, automobiles and the like. In order to produce the desired results, use is made of a casing provided externally with spaced lugs, a cylinder within the casing and containing a piston having its piston rod extending through the cap which closes the casing and the cylinder, and a pump having a barrel attached to the lugs and spaced from the casing to form a handle for the hydraulic jack, the pump having a valved connection with the cylinder by way of one of the lugs.

PIPE THREADING AND CUTTING MACHINE.—F. A. LOVEGROVE, 8 Campbell Rd., Halifax, Nova Scotia, Can. The invention has for its object to provide an inexpensive pipe



SHOWING THE MACHINE IN ELEVATION

threading and cutting machine which is simple and light in construction. The machine is strong and may be used to advantage either as a threading or cutting machine, it being possible to mount either cutters or dies in the machine, as desired.

LOADING MACHINE.—L. J. SLIFER, Route No. 1, Sterling, Kans. The invention has for its object to provide a machine by means of which dirt, sand, gravel and the like may be loaded directly from a slip or scraper to a wagon, the slip or scraper dumping directly on to the loading table, and lifting the loading table by the further movement of the scraper.

DRILLING MACHINE.—D. SPEHAR, Box 332, Miami, Ariz. One of the principal objects is to provide a drilling machine designed particularly for prospecting work which may be operate by one man, and so constructed that it may be readily taken apart, and packed in a relatively small space for transportation. Another object is to provide a drilling machine, in which the blows are delivered through the alternate contraction and expansion of a spring, and to automatically cause the intermittent rotation of the drill.

STAMPING MACHINE.—M FOGDE and L. P. SOUTHWICK, 2110 E. Clay St., Richmond, Va. The invention relates particularly to machines for applying revenue stamps to cigarette boxes, the primary object being to provide a simple apparatus which will obviate the difficulties and disadvantages of machines of this type. A more specific object is to provide a stamp applying apparatus of such a nature as to preclude gumming of the movable operating parts from the liquid adhesive applied to the stamps.

PRINTING DEVICE.—A. G. OGDEN, address, Multiple Offset Machine Co , 109 S. Charles St., Baltimore, Md. An object of this invention is to provide a device by means of which a sensitized plate may be moved with respect to a negative which is held in fixed position so that the design on the negative may be transfered to the plate a number of different times, means being provided whereby the plate may be moved slightly from the negative in order to permit its movement relatively thereto into another position. A further object is to provide means by which a sensitized plate may be quickly brought into position and may be stretched so as to prevent buckling of the plate, and means whereby the negative may be centered before being placed in its final position in the printing apparatus.

Medical Devices

IRRIGATING PAN FOR SURGICAL USE —M. B. HERMAN, 1132 Jefferson Ave., Memphis, Tenn. This pan is substantially triangular in form and provided with vertical sides which terminate at their upper edges in a flaring rim, whereby the pan is adapted for insertion and self-supporting between the thighs of a patient when seated, it is further distinguished by the form of its narrower end, which particularly adapts it for contact with the patient's body.

Prime Movers and Their Accessories

FLEXIBLE COUPLING.—W. J. FRANCKE, Highland Park, New Brunswick, N. J. The object of the invention is to provide a flexible coupling, more especially designed for use on shafts of small diameter and requiring an accurate steady transmission of the power such, for instance, as is used on the shafts of magnetos to insure proper ignition of the explosive charge in internal combustion engines.

FLEXIBLE COUPLING.—W. J. FRANCKE, Highland Park, New Brunswick, N. J. This invention has for its object to provide a flexible coupling, more especially designed for coupling shafts of large diameter and arranged to compensate either singly or combinedly for angular misalinement or for parallel misalinement, or for floating movement of the coupled shafts and without any tendency to push the coupling members apart or pull them together.

FLUID PRESSURE MOTOR.—M. S. DARLING, Conrad, Mont. The invention relates generally to fluid pressure motors and more particularly of the rotary type. An object is to provide a simple but efficient inlet and discharge valve for the fluid, by the turning of which the direction of rotation of the device may be readily reversed. Another object is to provide a compressed fluid actuated brake for the rotor.

EXPLOSIVE ENGINE.—M. S. DARLING, Conrad, Mont. This invention relates more particularly to an explosive engine of the character described in Patent No. 1,212,914 granted to the same inventor January 16th, 1917. The present invention is of the rotary type and provides readily renewable vanes of a simple and comparatively inexpensive type as well as means to maintain the same in thoroughly lubricated condition at all times so as to avoid any tendency to stick, it also provides a simple and effective starting means thus avoiding the necessity of power means for this purpose other than that, always at hand.

Railways and Their Accessories

LOCK FOR JOURNAL BOXES.—F. H. DAY, Box 764 Hopewell, Va. The invention relates to journal boxes for railroad cars, its general object is to provide a simple and effective lock for securing the lid of the journal box. The wheels and journal bearings, by this device are protected from theft of oil and packing, and are thereby prevented from accident while in transit, or from being destroyed by heat developed from the journal, in case the same becomes hot.

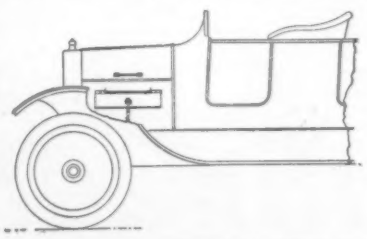
TRACK APPLIANCE FOR AUTOMATIC STOPS.—M. B. BULLA, 216 Martin Bldg., El Paso, Texas. The invention relates to automatic stops for railway trains of the type covered generally by patent No. 1,165,152 granted to the same invention December 1915. Among the objects of the present invention is to provide an appliance of a simple and portable nature adapted to be carried along with the flagman's equipment either on a train or elsewhere whereby the flagman may be sure that an oncoming train will be positively stopped whether the danger signal be observed or not by the engine driver of the oncoming train.

Pertaining to Recreation

MOVABLE TOY.—R. J. BURHEN, address St. Louis Union Trust Co., St. Louis, Mo. The object of the invention is to provide a movable carriage in connection with a frame and an elevated animal at the forward portion thereof, suitably supported through connection with the frame, together with certain connections between the animal and the carriage whereby, upon swinging movement of the latter the animal will be oscillated upon its pivot. The device is simple and capable of ready repair in case of breakage and ready renewal of any of the parts.

Pertaining to Vehicles

AUTOMOBILE HOOD.—S. A. DEANES, Box 165, West Point, Miss. An object of the invention is to provide an automobile hood which may be used both winter and summer, and which will obviate the necessity of providing an unsightly

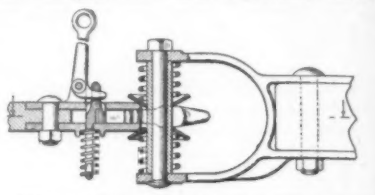


A SIDE VIEW OF AN AUTOMOBILE PROVIDED WITH THE HOOD

hood cover during cold weather, the hood has hinged portions with means for preventing the escape of heat from the hood in cold weather, or when it is desired to retain such heat, means are provided for opening the hood to permit the escape of heated air around the engine when desired.

TIRE FOR WHEELS.—G. RESTUCCI, Huovo Corso Garibaldi, No. 156, Naples, Italy. This tire for wheels comprises side plates adapted to be secured to the rim of the wheel and having projections on their inner faces, a spring band between the side plates engaging the projections, a plurality of blocks of double T-form connected together, these blocks being of a width equal to the distance between the side plates and resting on the band, and rollers arranged between the blocks.

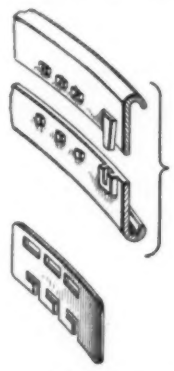
COUPLING.—J. W. BULLER, Hillsboro, Kan. The invention relates to coupling devices and particularly to a coupling to be used in a tractor and trailer or between the various trailers, it has for an object the provision of an arrangement of coupler which may be quickly and easily coupled and uncoupled but which is pivotally locked



A LONGITUDINAL VERTICAL SECTIONAL VIEW THROUGH THE COUPLING

when in a coupled or closed position. Another object is to provide a structure having a couple head and link formed with resilient means for taking up the up and down motion between the parts. A still further object is to provide a device in which a vertically movable block is utilized for holding the coupling jaws in a locked position.

COUPLING MEANS FOR DEMOUNTABLE RIM SECTIONS.—F. B. CUMPSTON, Blooming Grove, Texas. One of the principal objects of the present invention is to provide a coupling means for circumferentially divided demountable rim sections, in the nature of a locking plate

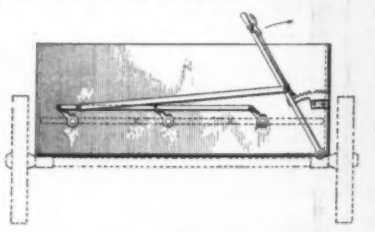


PROSPECTIVE VIEW SHOWING RIM SECTIONS, ARRANGEMENTS OF LUGS, AND LOCKING PLATE

slidably carried on the under side of one of the sections, and having hooks adapted, when the sections are put together, to overhang a portion of the opposite section, and to be shifted for engegement with keeper lugs carried on the under side of the opposite section.

SPRING WHEEL.—O. G. WORSLEY, 6536 Woodlawn Ave., Chicago, Ill. The invention relates particularly to that type of spring wheel including circumferentially spaced felly and rim portions with interposed shock absorbing means, the object is the provision of readily accessible and highly efficient sprins members the disposition of which will promote uniform distribution of strain, effective transmission of rotary movement, and maximum elasticity with minimum breakage.

DUMPING WAGON.—W. J. MCGEE, Daisy, Ga. The invention relates generally to dumping wagons, and more particularly to a dumping wagon the bottom of which consists of a plurality of slats, the object here being to so arrange the slats and to provide such an operating mechanism in connection therewith that the dumping of the



A FRONT ELEVATION OF WAGON EQUIPPED WITH THE DEVICE

wagon, even under heavy load, may be accomplished quickly without strain either upon the slats themselves or the operating devices, there are forward and rear levers, enabling the operators to dump the contents of the wagon from either end or at both ends by applying power simultaneously.

Designs

DESIGN FOR A COMMEMORATION TABLET.—M. FYSCHER, 1356 University Ave., Bronx, New York, N. Y. The tablet includes an ornamental design with an opening in the center for the insertion of a picture, the opening is surrounded by circles in the forms of medals, on which are shown in relief, the heads of thePresident of U. S., the King of Great Britain, Marshall Joffre of France, the King of Belgium, the King of Italy, the King of Romania, the King of Servia the coats of arms of Russia, Japan, Portugal and Montenegro.

DESIGN FOR A WALL COVERING.—E. C. BAECK, 130 N. Broadway, Irvington-on-Hudson. N. Y. This design for a wall covering, as shown by the figure in the patent, represents a woven effect.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee title of the invention, and date of this paper.

The Current Supplement

FOR a long time it was supposed by many that increased perfection of machinery, particularly of the so-called automatic type, and of technical processes, would prove to be a solution of labor problems, but the increase in demand for manufactured products has fully kept pace with the improvements effected, and in the last analysis it has been found that the human potential is the controlling factor in industry. This conclusion was steadily forcing itself upon the attention of economists before the war cloud developed, but as the great world struggle progresses the fact that man will always dominate in every branch of human endeavor is being demonstrated more and more forcibly. A valuable paper on *The Human Potential in Industry* will be found in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2190, for December 22d, an illustrated article on *Fustic* tells of an important natural dye wood. *Marine Engineering from 1911 to 1917* is a review of the development of machinery for propelling ships that is particularly interesting at this time. *Safety in Industry* is an interesting account of what is being done by a large manufacturing corporation to prevent accidents in their works, and to render prompt aid in cases of injury. It is illustrated by a number of excellent photographs. *Between the Tigris and the Indus* gives much valuable information in regard to an important district where the British forces are contending for supremacy against German influence—a supremacy that will be of great significance after the war. *Building a Moving-Picture Camera* gives the constructive amateur detailed instructions how to make a serviceable machine at a cost of but $6.50. It is accompanied by complete explanatory drawings. *Color and Color Photography* reviews the problems involved in making colored pictures, and gives an outline of the successful processes in use. There are a number of other valuable articles on various subjects.

Zeppelin, Aeroplane and Parachute

(Concluded from page 474)

conversation out of the question—all these are formidable drawbacks.

In the Zeppelin, on the contrary, there are none of these inconveniences. No trace of vibration at the observation stations; perfect protection from the wind by glazing; entirely unobstructed view; comfortably equipped quarters with abundance of space, making even exercise possible; the most powerful telescopes, with no vibration to interfere with their use and no obstructions to prevent their free focusing in any direction; many eyes and many minds, and the possibility of free interchange of observations and opinions—these are the secrets of the Zeppelin's advantage over the plane for the work of attacking land stations from far up in the air.

In casting bombs from these altitudes the Zeppelin is immensely favored, too, by its great weight, which makes it immune to deviation under the influence of the air currents. Equally important is the fact that sighting devices are vastly superior to any an aeroplane can carry. Knowing the exact altitude above the ground is the fundamental requisite of successful bombing. This means difficult and specialized work for more than one man—work with maps, statoscopes, barometers and slide rules, with intelligent comparison of results. A company of mediocre engineers, with the equipment made possible by the Zeppelin, would far outclass the keenest technical expert riding alone in his aeroplane and working with the poorer tools that his mount makes necessary. A similar advantage accrues to the benefit of the Zeppelin when it comes to ascertaining the vertical direction. To a man hanging on a rope this is an easy problem; to a man suspended from nothing in the middle of nothing it is an impossibility without the most delicate instruments. The wonderful steadiness of the Zeppelin, doing away with all accelerations, together with the absence of vibration, permits the use of Lieutenant Scott's simple pendulum-controlled telescope. No wonder that the aiming, in daytime, of heavy bombs from two miles in the air has become to the Zeppelins as exact a science as is the directing of a 42 centimeter mortar.

With the night attack, however, made imperative even at altitudes of 10,000 feet by the fire danger of the hydrogen, the element of uncertainty enters. One cannot hit, with certainty, a darkened object that does not clearly trace itself under the phosphorescent cross-hairs of the telescope; the slightest blurring will send the bomb wide of the mark, just as it would in long-range gunnery. On the other hand, luminous spots will be hit instantly by a well trained marksman. Thus it is explained how firing batteries were silenced, firing destroyers sunk, searchlights extinguished, while the real objective, some large factory buildings, were missed when they remained in darkness.

The Zeppelin of today, plainly, would be a dire peril indeed if the art of defense had not kept pace with that of attack. To a great extent this is due to mere practice. The almost daily firing at aerial targets during two and a half years has been an invaluable exercise for air-defense gunners. Then, too, the formidable nature of the present air defense of great centers like London and Paris, freely conceded by the Germans, is frequently a mere matter of quantity, of the multiplication of searchlights and batteries. It has long been known that rifle fire will surely touch air craft, simply because thousands of rifles are concentrated upon the common target. The inefficiency of such fire, in terms of concrete results, is due, not to failure to hit, but rather to the harmless nature of the tiny bullet hole, alike in the aeroplane and in the gas bag. But when a projectile from a large gun hits a Zeppelin, that Zeppelin is going to fall; so mere multiplication of cannon and the searchlights that go with them will finally provide a positive barrier against aerial attack. The Germans themselves testify how easily they used to dodge the normal number of guns, but how great became the danger, later, of the storm of shells from the multiplied batteries. They even describe, as the ultimate purpose of the Zeppelin raids, the keeping of all these guns and men tied up in Paris and London.

It would seem that the present situation is an acute one, especially trying to the men who sail in the Zeppelins. These craft are brought down more frequently than they were; and there seems little prospect of making them any less vulnerable to the efficient attack they now must meet whenever they venture over foreign soil. Perhaps the most gruesome sight in this gruesome war is that of the men aboard one of these ignited air monsters being burned at their floating stake. Every other victim of war has at least a gambler's chance for his life, right up to the last minute; the Zeppelin crew, from the moment their ship catches fire, are lost beyond redemption. Now the parachute, when first tried out by the French as a means of escape from captive balloons that had been ignited by hostile fire, proved such a success that it is now a recognized part of the equipment of every "sausage." Yet, when, in the late Zeppelin disaster near Paris, the crazed crew finally were driven to jump, they could only hurl themselves headlong through space to a certain death. They had no parachutes, nor does any Zeppelin carry such an article.

It is not clear why this should be so. The natural inference that a parachute could not come clear of the falling wreckage is not necessarily in accordance with the facts. For a wounded Zeppelin does not at once plunge earthward with all the speed of a freely falling body. At the very first ignition of the gas in the great bag the ship is doomed; yet an interval of real duration ensues, during which it at first maintains its elevation unimpaired, and then settles gently downward. While inflammable, the gummy fabric of which the gas bag is made presents sufficient resistance to the flames to make its instantaneous consumption out of the question; and until it is substantially burned up it will hold enough gas to keep the ship partly afloat. Official reports of Zeppelin disasters are at hand confirming this, and making it plain that

many seconds elapse before the huge framework really begins to fall with the full acceleration of 32 feet per second per second which results from unhindered operation of the law of gravitation.

The parachute, on the other hand, falls like a stone for the first four or five seconds, before it opens. Moreover, when closed it presents no rigging or projecting parts to get entangled in the guys of the Zeppelin. It should be a simple task so to suspend parachutes at the rail of the car that they could be cut loose for a drop at an instant's notice and with hardly an instant's delay. Hence it is plain that no difficulty would be experienced in getting clear of the blazing framework.

This done, the further complication would enter of keeping clear. Knowing the time that will elapse before a parachute opens, and the time that will elapse before a Zeppelin begins to fall freely, it is a matter of elementary mathematics to compute the time that it will take the latter to overtake the former from above and involve it again in the wreck from which its passenger seeks to escape. If the initial elevation is sufficient to make it certain that this time will be spent before the parachute reaches the ground, it is necessary to have some means whereby it can be deflected from the course which the hot metal framework of the Zeppelin will follow. The parachute, in other words, must get off the track or be run down. It is hardly to be supposed that the pilot of the parachute could get clear of the Zeppelin's ultimate course by diving from the car in place of dropping; but it seems probable that he could steer his parachute away from the wreckage by pulling upon his ropes so as to bring his weight upon one side of his carrier and make the latter glide off toward the lowered side. In any event, the bare chance of safety is infinitely preferable to certain destruction; and it would seem that in omitting this obvious safeguard from the Zeppelin equipment the German authorities must have been guided by military rather than by engineering considerations. That is to say, in official German circles it is regarded as undesirable that the Zeppelin crew be provided with means of escape from their ship. This is consistent with what we know of the Prussian militarist temperament.

The Trench System of Defense vs. The Pill-Box System

(*Concluded from page 469*)

the attackers even after they have reached their objectives, so that the German troops coming across open ground in the counter-attack are subjected to a hurricane of fire just as if they were the original attackers.

Compared with the old trench system, the pill-box arrangement places the defenders' supporting troops too far back of the front line, with the result that the counter-attack is delayed until the attackers have an opportunity of organizing their ground. Furthermore, because of the absence of communication trenches, the counter-attack must be carried out in the open with absolutely no protection against hostile fire. Again, the garrisons of the isolated pill-boxes do not have the sense of safety that the trench defenders had, for they usually know that it is a fight to the finish with the "moppers" and that reinforcements cannot reach them.

On the other hand, no matter how badly the trench system has been handled by hostile artillery, there are enough elements left to organize some sort of defense when support troops come up to what remains of the communication trenches.

Summed up, the pill-box system is practical if the enemy attempts to penetrate a considerable distance into the defensive zone by the usual method of first bombarding and warning the defenders of the impending attack. But if the attackers only attempt to penetrate to a moderate distance and then hold on to what they have conquered, the pill-box defense fails because of the distance the German support troops must traverse and the lack of communication trenches. It is simply a matter of being satisfied with a little gain at a time, instead of trying to break the German lines and settling the war in one battle.

Recording Sound on Motion-Picture Film

(*Concluded from page 473*)

of sound "peaks," however, the inventor uses a larger area of the selenium cell, resulting in much better results.

The rest of the reproducing process is simple. A sensitive relay is used in circuit with the selenium cell, while a loud-speaking telephone of special design and operating on a pneumatic principle which the inventor cannot make public at present receives a current of constantly varying strength from a second circuit. This current is converted into sound waves which, in an amplified form, are propagated throughout a large theater.

Public exhibitions of the new talking pictures were given in England at various times during the past few years, and even the most exacting of English critics have credited Mr. Lauste with a marvelous system of recording sounds. At the present moment the inventor is busily engaged in repairing his equipment which has been rather badly handled in the journey to America, so that exhibitions are not possible as yet.

While in its present state of development the talking-picture system just described is claimed to be ready for the public, Mr. Lauste is the first to admit that many refinements remain to be made to bring the system still closer to the ideal. Indeed, he has developed an ingenious system of flickerless cinematography which makes use of a plain film, devoid of perforations, and in which the celluloid strip is not subjected to the usual mechanical strains. This system, which employs no shutter yet blends one picture into the next in a most realistic reproduction of the subject photographed, will be described in these columns in the near future. Together with the sound-recorder, these two contributions appear to be a big step toward the ultimate goal of motion pictures.

Additional Secrets of the Super-Zeppelins

(*Concluded from page 478*)

Aside from affording a means of communication between various parts of the aerial leviathan, the "cat-walk" serves as sleeping quarters and as storage space. The sleeping quarters are represented by a number of hammocks supported a few inches above the outer fabric cover, to one side of the pine board-walk. Fuel tanks and ballast tanks are suspended from the framework on either side of the board-walk, and it appears that the bombs are also supported in the passageway. The fuel reservoirs are aluminum cylinders of 300-liter capacity, and are suspended in groups of two or three. Means are provided for readily releasing these tanks through trap doors in the bottom of the passageway, in the event that every pound of weight which can be spared has to be dropped to lighten the Zeppelin so as to ascend rapidly. Tubes connect the fuel tanks with the engines in the nacelles below, and aside from the main fuel tanks a number of others, not piped to the engines, are kept on hand as an emergency supply.

The ballast reservoirs which replace the former sand bags are made of waterproof cloth and provided with an aluminum spout at the bottom. Each ballast unit has a capacity of 1,000 liters of alcoholized water, and it is of interest to note here that the freezing of this liquid ballast prevented the L-49 from making for the higher altitudes to escape hostile battleplanes, after the gas supply had become seriously depleted through long flight. The ballast reservoirs are suspended from the framework of the "cat-walk" by means of steel cables.

Four nacelles house the engines—two laterally suspended near the center of the airship, and one near each end. The rear nacelle carries two motors, one of which is an emergency unit. In the former description of the L-49 the statement was made that each nacelle carried two engines which could be employed singly or in tandem in driving the propeller. This statement, it now appears, only applies to the rear nacelle, all the other nacelles being provided with a single engine and propeller. Each engine is rated at 240 horse-power,

making a total of 1,200 horse-power for the airship. Each propeller measures five meters in diameter. The nacelles, which are more or less egg-shaped, are occupied mostly by the engines, and it is reported that little space is left for the tenders; in truth, the crew in this respect are working under conditions no more enviable than sailors aboard a German U-boat.

The front nacelle is divided into two compartments, the forward or commander's quarters provided with sliding plate glass windows in front; and the rear or engine room. The commander's quarters appears in one of the accompanying illustrations, and it will be noted that all the controls of the huge airship are centered here. Among the instruments appearing in the view are a compass and the steering wheel in the center, the bomb-sighting apparatus at the right, with a tank of compressed oxygen just below, and the commander's parachute rolled up at the left. By means of a keyboard the cargo of bombs can be dropped one by one, while a battery of electric lamps shows which bombs have been released. A signal telegraph permits of instant communication with the various engine rooms.

That the present super-Zeppelin is a vast improvement over its predecessors is evident from a study of its lifting power, which is said to be 60 metric tons. This is distributed about as follows: Framework, 30 tons; two middle nacelles, 2 tons; two end nacelles, 4 tons; fuel for 24-hour flight, 7 tons; equipment and accessories, 1 ton; 19 passengers, 1½ tons; bombs, 2 tons, making a total of 47½ tons. This leaves a margin of 12 tons of lifting power, which is ample for all navigating conditions.

The crew comprises 19 men and two officers, who are posted as follows: two in each of the middle nacelles, three in the rear nacelle which contains two engines, and four in the front nacelle. The remaining members are placed in the passageway or "cat-walk," where they take care of the ballast tanks or snatch a few hours' sleep until called upon to relieve other men. The crew of such a craft, it goes without saying, must be composed of exceptional men—men who can withstand extreme cold, lack of oxygen, and constant nervous strain.

Our Great Need for Toluol and a New Way to Make It

THE United States Government's needs for toluol for war purposes are just divulged as tremendous. A reliable estimate puts the figure at 22,000,000 gallons for the next 12 months. It is all to be converted into tri-nitro-toluol for high explosive shells. Where this very large quantity is to come from has been a source of considerable anxiety and is so still. Up to this time practically all of that needed has come from the by-product coke plants of the country. It appears as one of the by-products in coke-making and is recovered along with benzol in the benzol recovery plants. The present available output of the country from such plants for the next year is estimated at 11,000,000 gallons or only 50 per cent of the quantity needed.

About two years ago, there was great interest manifested in the discovery of a process for making toluol from crude oil, and claims were made that while the production was not strictly a commercial one, still in a national emergency, this process was the great back-log and that when the need came, the material could be rapidly produced. The emergency has arrived, and the nation needs millions of gallons of toluol for itself and its Allies. In the meantime, there has been going on without any publicity a development in toluol manufacture which bids fair to be of the utmost importance to the nation in the supply of tri-nitro-toluol. Early in 1915, a large company in Pittsburgh, which at that time was building a large number of by-product coke plants and, in connection with these, also benzol and toluol plants, started in the laboratories at the Mellon Institute, an investigation into the recovery of toluol from carbureted water gas—the gas made in all the large cities of the country by the gas companies for domestic use.

The conditions existing in water-gas plants were very different from those in by-product coke plants, and special apparatus and special methods had to be devised for the successful recovery of toluol. These were first installed in conjunction with the gaslight company at Washington, to effect the removal of toluol from 5,000,000 cubic feet of carbureted water-gas per day. This plant was placed in operation on July 14th, 1916, since which date there has been secured approximately 200,000 gallons of toluol. While this plant was the first to use this process, and many improvements increasing the efficiency and economy of operation have been introduced, the plant has proved to be a commercial and technical success, equalling the results promsied by the laboratory methods. Since that time, a number of duplicate installations have been built as follows: two at Newark, one at Paterson, one at Jersey City, two at Trenton, two at Rochester, one at Chicago ,and one at Evanston, Ill.

Now that the Government has found what an enormous amount of toluol is required and that the tri-nitro-toluol is the most efficient and most satisfactory explosive, the Ordnance Department of the Army has taken hold of the situation. It finds that every by-product coke-oven plant in the country is producing or has arranged to produce toluol to its utmost capacity, and that the remaining needed toluol must be secured from city gas. Seventy-two plants are available for this recovery distributed over the entire country. The Pittsburgh company mentioned has arranged with the Government to build "stripping" plants in a number of large cities, and many more are being designed and estimated upon. The plans for securing toluol from these sources involve the use of excess refining capacity in all the by-product coke plants of the country.

Process for Using Spoiled Potatoes

BECAUSE of the scarcity and high price of all kinds of foods, numerous methods have been devised not only to prepare new viands and to reduce consumption, but to utilize more completely some products which were wasted before. One of these very interesting methods, just devised by M. Ducomet, a professor of the Rennes National Agricultural College, makes possible the saving of potatoes spoiled either by the phytophtora disease or by frost. This scientist discovered that for months, the starch of the potatoes, that is to say nine-tenths of its food value, resisted the action of the different ferments which give the bad odor and disagreeable appearance to the tubers. Then, after many experiments, he devised the following method enabling the farmer to utilize the spoiled potatoes which otherwise could not have been used even to feed hogs.

The tubers, having been washed, are abandoned in piles until completely spoiled. They are then crushed with a little water and the mass put through a sieve. To the pulp obtained in this way is added twice its volume of water and the mixture is put in an open barrel, stirred and allowed to decant. After a while, the liquid is decanted by opening a hole placed at a convenient height. (Each barrel must be punched a vertical series of holes, which are corked in order to be easily opened when necessary). Water is added again to the mass, the mixture is stirred, allowed to rest, decanted, and so on, until the decanted liquid has not any more its disagreeable odor. Four or six treatments are needed according to the spoiled condition of the tubers. The mass is finally poured on a cotton fabric, and the starch thus obtained used in making bread by kneading with ordinary wheat dough. When it must be conserved, the starch is dried in the bread oven which is found in each old fashioned French peasant house.

A laborer can prepare in a day about two hundred pounds of starch. The wages he receives are the total cost of the starch extracted, since the potatoes would have been wasted if not utilized in this way.

NEW BOOKS, ETC.

A Roman Alphabet and How To Use It. By Frank Forrest Frederick. Published by the Author at Trenton, N. J., 1917. 8vo.; 28 pp.; illustrated. Price, 75 cents.

The beginner in lettering will find here some basic instruction that is too often omitted in the more comprehensive works. The letters of just one Roman alphabet are carefully studied, their comparative widths determined, the rules for light and heavy strokes given, and the way in which a given number of letters may be made to fit a given space explained. Separate cards of alphabets go with the book, and by cutting apart each letter the art of composing is greatly simplified.

Problems in General Physics for College Courses. By Morton Masius, M.A., Ph.D. Philadelphia: P. Blakiston's Son & Co., 1917. 8vo.; 96 pp. Price, 90 cents.

These problems are based upon Duff's Text-Book of Physics, and deal with the mechanics and properties of matter, wave motion, heat, electricity and magnetism, sound, and light. Almost one-half of them come from the examination papers of the Worcester Polytechnic Institute; altogether they make up four complete courses of 250 problems each, each course proceeding from simpler to more difficult examples; by judicious selection the instructor may readily make up from them an easy or a hard course, and this flexibility renders the work adaptable to the need of almost any engineering college.

Analytical Reagents. Standards and Tests. Compiled by Edmund White, B.Sc., F.I.C. London, England: Hopkin & Williams, Ltd. 8vo., 92 pp. Price, 1s. net.

For substances used in commercial analysis a certain degree of purit y isnecessary. It is this degree, known to the trade as "chemically pure," which the tests here give are adapted to discover. The subjects are taken up alphabetically, from acetic acid to zinc sulphate, with descriptions and tests culled from numerous authoritative sources as well as from the experience of the author. The analyst will appreciate the convenient form in which this information is presented.

Standard Table of Electrochemical Equivalents and Their Derivatives. By Carl Hering, M.E., D.Sc. and Frederick H. Getman, Ph.D. New York: D. Van Nostrand Company, 1917. 12mo.; 140 pp.; illustrated. Price, $2 net.

A table of constants based upon the latest fundamental values is offered in this little reference book, by means of which the investigator may determine the amounts of substances deposited, dissolved, or otherwise chemically changed by an electric current, and a simple explanation of these calculations is given by the aid of practical examples. A second division of the work summarizes the physical conception of electrochemical phenomena, and treats briefly of electrolysis as based upon the dissociation theory. Appendices deal with valence, the elementary principles of chemical reactions and calculations, and conversion factors used in electrochemical calculations.

Nature's Invisible Forces. By Thos. H. Ellis. Published by the Author at St. Louis, Mo., 1917. 8vo.; 270 pp.; illustrated. Price, $2.50.

The author's exposition and analysis of the "seven principles of nature," which he designates as time, space, consumination, affinity, numerics, evolution and compensation, evidences deep thinking and not infrequently presents ideas that are stimulating in the originality of their expression; that he takes issue with some of the accepted theories of science need not deter the reader from enjoying his ingenious speculations; while German scientists are abolishing, among other things, the ether, Mr. Ellis makes of it the vital principle. Properly regarded, the distinctly individual viewpoint, while it may foreshorten some objects, often throws others into more favorable aspects for investigation, and leads the student to examine more closely the bases of our knowledge; and pungency and individuality are here in abundance.

How to Fly. A Practical Course of Training in Aviation. By Captain D. Gordon E. Re Vley. Arranged by Glad Lewis. San Francisco: Paul Elder and Company, 1917. 16mo.; 110 pp. Price, $1.

This manual, of a size to slip easily into a very small pocket, brings together the essential facts of theory, control, rolling, hopping and the straightaway for learners, the turn, and the more difficult evolutions and landings. American requirements and tests for pilots are given, with hints for daily practice and suggestions to instructors. A useful glossary concludes a very clearly-worded, concise and authoritative treatise.

Twentieth Biennial Report of the Kansas State Board of Agriculture. For the Years 1915 and 1916. Topeka: Kansas State Board of Agriculture, 1917. 8vo.; 757 pp.; illustrated.

Every feature of agricultural life and activity in Kansas is unfolded by this Report. The many illustrations show homes, farmyards, schoolhouses, county fairs and livestock; the compilers seem to have overlooked nothing. Rural welfare, extension service, home economics, farm management, rural engineering, soils and crops and farm forestry are all made the subjects of interesting papers. There is a long, classified list of books for farmers, and the statistics by counties and the census tables set forth numerous vital facts. It constitutes an absorbing story of human achievement, and the methods and ideas presented are largely applicable to farm life everywhere.

The Principles of Aerography. By Alexander McAdie, Professor of Meteorology, Harvard University. New York and Chicago: Rand McNally & Company 1917. 8vo.; 334 pp.; illustrated. Price, $3.

Prof. McAdie here gives us much new material, set forth with such an eye to economic applications and such enthusiasm for the marvelous features of his subject that the interest of the reader and student is immediately caught and held. There are accurate records of moonlight and clouds, a comprehensive treatment of the spectra of lightning, thorough studies of the flow of air at varying levels, of ice storms, ocean currents, and solar phenomena; the unique illustrations are not only an artistic embellishment but also a graphic source of information. Aerography is shown to be the handmaid of commerce, agriculture and modern warfare. Among other aids offered the aerologist may be mentioned the centimeter-gram-second system and the formulas for calculating atmospheric pressure. An appendix charts the three accepted temperature scales side by side for comparison, and contains also helpful data and tables.

Descriptive Mineralogy. By William Shirley Bayley, Ph.D. New York and London: D. Appleton and Company, 1917. 8vo.; 559 pp.; illustrated. Price, $3.50 net.

In making a selection of minerals for description, Prof. Bayley has been guided by the scientific interest and economic importance of the substances, as well as by their illustrative value in making clear the principles of classification. The work is purely a text for college classes, comprehensive rather than detailed; the discussions take the viewpoint of modern chemistry and serve as an introduction to economic geology. The foundations of general chemical mineralogy are laid in the initial chapters; the second part of the work treats of descriptive, and the third of determinative mineralogy; in the latter section, a simple guide to the descriptions is substituted for the usual "key to the determination of species," and the work is lavishly illustrated throughout with diagrammatic drawings and photographic reproductions.

A Dictionary of English and French Military Terms. In Two Parts. By Albert Barrère. London, England: Hachette & Company, 1916. 16mo.; 118 pp. Price, each part, 2s. net.

Military Expressions in English, French and German. Compiled and edited by E. G. A. Beckwith, M.A. London, England: Hachette & Company, 1915. 16mo.; 76 pp. Price, 1s. 6d.

In "A Dictionary of English and French Military Terms" a long list of words is translated from English to French in the first volume, and from French to English in the second. An appendix gives the nomenclature of ordnance used in the service, the mountings for coast defense, nicknames of some of the old regiments, weights and measures, the conversion of money, and the names of countries and towns. "Military Expressions" is compiled with a similar object in view, but includes also the equivalent German words and is complete in one volume. The terms are arranged under such headings as organization, material, aero words, etc.; the gender of the foreign terms is indicated, and there are notes on usage with plenty of space for penciling others. Both works are of handy pocket size, and both possess distinct points of appeal to the man who expects to do service on the French front.

Science German Course. By A. G. Haltenhoff. London, England: Hachette & Company, 1911. 8vo.; 232 pp. Price, 3s. net.

The student commencing German with science in view will find this course suited either to class or home study; it is based on the conversational method, and the graduated readings touch upon many subjects, from chemistry to political economy; there are grammatical rules and hints, and a selection of questions taken from the German science papers set for the London University examinations.

Eggs in a Thousand Ways. A Guide for the Preparation of Eggs for the Table. By Adolph Myer. Chicago: The Hotel Monthly Press, 1917. 16mo.; 141 pp. Price, $1.

This vest-pocket cook book by a noted chef is devoted solely to the versatile egg, and gives brief directions for its preparation, classifying the recipes under the dozen really distinctive methods of cooking. Indexed and cross-indexed, the little work gives quick access to any method or any garnishing required, and is probably the most comprehensive work of the kind. Aside from its usefulness to the cook, it should appeal also to the epicure, who generally prides himself upon the knowledge of how the dishes he delights in are made ready for his use.

Exercise and Review Book in Biology. By J. G. Blaisdell, Ph.B., Ped.B. Yonkers-on-Hudson, N. Y.: World Book Company, 1917. 4to.; 160 pp.; illustrated. Price, 80 cents.

This combined laboratory guide, notebook and review book for students' use is a novel and most convenient arrangement that meets the requirements of the Regents of the University of the State of New York, and is adapted to any of the State first-year high-school courses. By giving on each page full directions to the pupil, space for his notes and drawings, and the questions and tasks of the lesson itself, much time is saved and numerous pedagogical advantages are developed.

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SCIENTIFIC AMERICAN

A PERILOUS PARACHUTE LANDING IN WINDY WEATHER [See page 498]

December 29, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

The
SCIENTIFIC AMERICAN
For 1918

To be of greater national service than ever before is our New Year's resolution

With next week's issue the SCIENTIFIC AMERICAN enters the 74th year of its existence.

Great changes have come over this country under the stimulus of war. We have begun to realize the importance of the United States in the world. In the past, our chief concern has been with matters within our own borders. The war, however, has taught us that we are very much a part of the entire world and have duties to perform outside of our own frontiers. It has broadened our scope of vision, and the broadening influence of the war is bound to be followed by a tremendous development in all our activities.

When this country began to realize its industrial dependence upon outside nations, the SCIENTIFIC AMERICAN was one of the first periodicals to point out the necessity of developing our industries, not only to make us independent but also to bring our commodities into foreign markets.

The interest in foreign trade has been intensified by the demands of foreign countries which have been cut off from their normal sources of supply by the great European conflict. They have looked to us to supply the deficiency. This has given us trade opportunities such as we never had before, and our commerce is penetrating into all lands.

Three New Departments

This development, however, is so new that many serious problems are constantly arising. Accordingly, the SCIENTIFIC AMERICAN has decided to open a Department of ***Foreign Trade,*** in which will be discussed the latest regulations of the Government and their effect upon various lines of trade. These matters will be presented in concise form so that they may be grasped readily by the man who has no time to peruse long papers. In addition to this, the department will deal with the needs of foreign markets and the opportunities they offer for American goods.

As a result of the war, there has been a great chemical awakening in this country. Our development in the field of industrial chemistry is unparalleled. Hitherto, the chemical industries have not received a full measure of public support because chemistry has been considered too abstract a subject for the average man to understand. The romance of chemistry, however, is a most engrossing subject, and if properly presented, there is no reason why it should not be of great interest to every one. To stimulate this interest the SCIENTIFIC AMERICAN will publish a department devoted to the ***Latest Chemical Advances.***

A third new department, which will be inaugurated in the SCIENTIFIC AMERICAN of 1918, will be devoted to the ***Mechanical Equipment of the Farm.*** Hitherto much has been written about the raising of crops and high grade stock, but little has been said about the equipment of the farm. We believe that there is a demand among farmers for a department which will keep them in touch with the latest mechanical and engineering developments that pertain to the farm. It is to meet this demand that the SCIENTIFIC AMERICAN has added this department.

In addition to these departments the SCIENTIFIC AMERICAN will continue its pages devoted to new and interesting inventions, its monthly articles on astronomy and its department devoted to the commercial vehicle which is assuming greater importance than ever in these days of congested transportation.

The weekly page of Notes published in the SCIENTIFIC AMERICAN gives a digest of current events in the fields of Science, Electricity, Engineering, Motor Vehicles, Aeronautics, Industrial Efficiency and Naval and Military Matters.

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